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ELEMENTARY HORTICULTURE
FOR
CALIFORNIA SCHOOLS

A Manual for Teachers
and Amateur Gardeners

BY

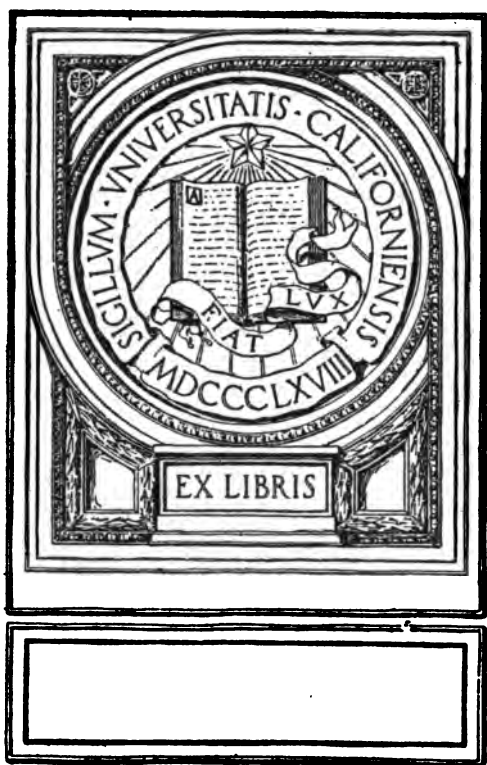
CLAYTON F. PALMER



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UNIV. OF
CALIFORNIA

ELEMENTARY HORTICULTURE
— FOR —
CALIFORNIA SCHOOLS



A MANUAL FOR TEACHERS AND AMATEUR GARDENERS



— By —
Clayton F. Palmer
Instructor in Agricultural Nature Study
Los Angeles State Normal School



Kindergarten Plots at the Normal School

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TO VIND
ABROGATED

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BY

C. F. PALMER

PREFACE



The manual herewith presented has been written, primarily, to serve as a guide for the use of classes in Agricultural Nature Study in the Los Angeles Normal School, and in the Training School. It is also hoped that it may arouse the interest of at least a few teachers of our state in some of the phases of elementary horticulture herein discussed.

The writer desires to express his appreciation of the helpful suggestions received from President J. F. Millspaugh and Dr. F. A. Howe of the Normal School. The half-tones for figures 2 and 3 are presented through courtesy of the International Children's School Farm League of New York City. The garden scene is a view of a portion of the now well-known De Witt Clinton Park. The line drawings shown in figures 9 and 10 were made by Miss de Garmo, a student of the Normal School.



"I dropped a seed into the earth. It grew, and the plant was mine. It was a wonderful thing, this plant of mine. I did not know its name, and the plant did not bloom. All I know is that I planted something apparently as lifeless as a grain of sand and that there came forth a green and living thing, unlike the seed, unlike the soil in which it stood, unlike the air into which it grew. No one could tell me why it grew nor how. It had secrets all its own, secrets that baffle the wisest men; yet this plant was my friend. It faded when I withheld the light, it withered when I neglected to give it water, it flourished when I supplied its simple needs. One week I went away on a vacation, and when I returned the plant was dead; and I missed it."

—L. H. Bailey, in *Junior Naturalist Monthly*.

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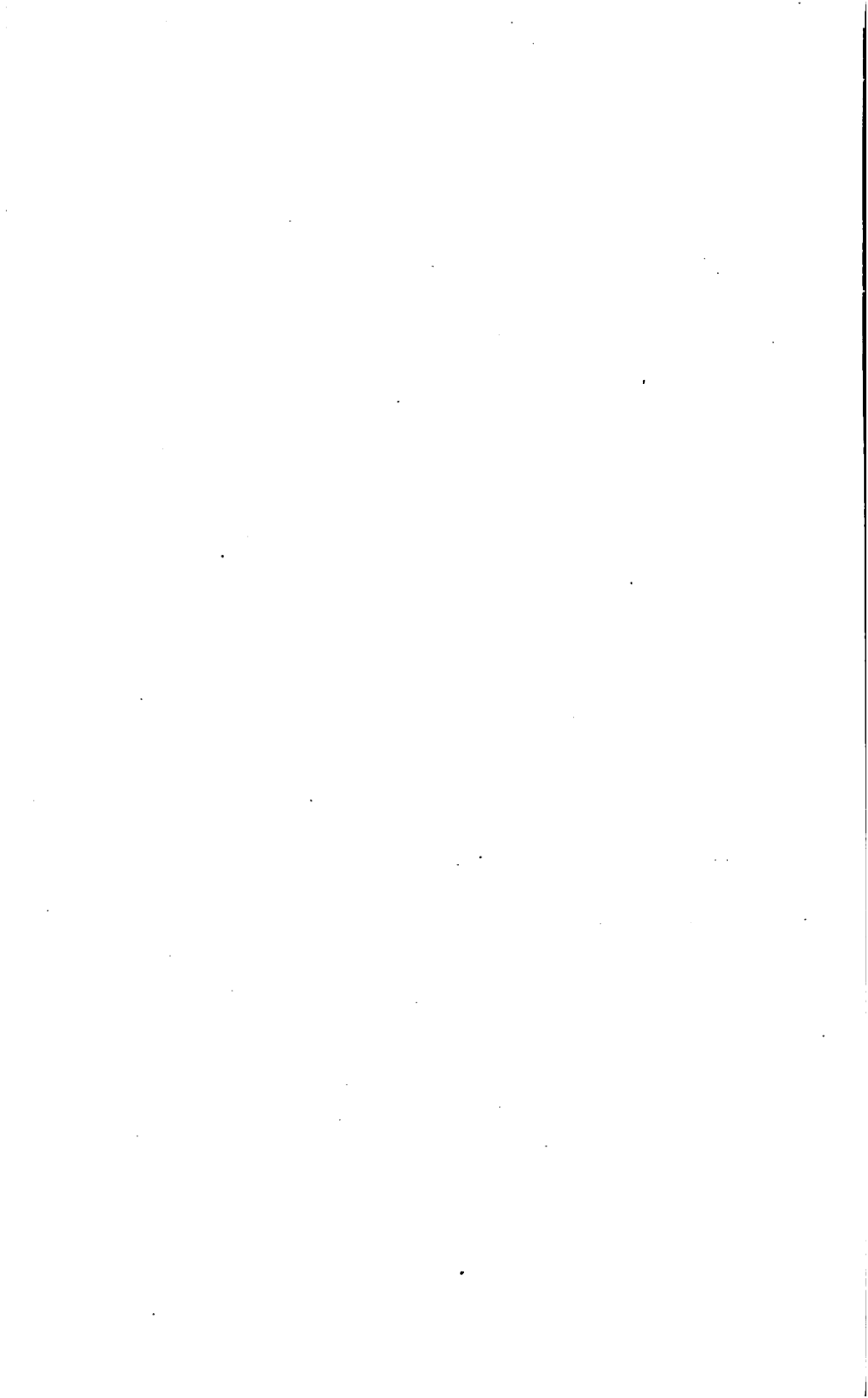
Introduction

Elementary agriculture is fast claiming for itself a prominent place in the curriculum of many of the high schools of our state which are located in communities having important agricultural interests. The instructors in most of these cases are men trained for the work they are doing.

The movement in favor of agriculture as an elementary school subject, is somewhat retarded, and largely because there is a general lack of teachers trained to initiate and carry on the work. This condition seems likely to prevail for some time to come, in spite of the courses in agriculture offered by our state institutions and the helpful bulletins available for reference.

A great deal has been said and written favoring school gardens as a valuable phase of nature study, or more specifically, agriculture. Having conducted the work with several hundred students, and watched as many grade pupils at their garden work, the writer is firmly convinced of its value, and earnestly urges every school, which has available ground, and a teacher willing to undertake the work, to profit by the opportunities offered by the growing of plants. But there are many schools which can neither spare nor secure sufficient ground for a garden, and it is perhaps rather to such that this manual will appeal. Several different phases of plant production have been discussed briefly, and it is believed that every school will be able to make use of at least a few of these suggestions.

It is anticipated that some of the more conservative teachers and school officials will at once challenge the advisability of attempting to do in the grades much of the work recommended with plants. But since most of that herein suggested has been successfully done by pupils in the grades, and under somewhat unfavorable conditions, the writer feels that it is worthy an honest trial by such teachers as are willing to undertake it.



The School Garden

Conditions are such that much of the school garden work being done in our state is voluntary on the part of both teachers and pupils. Comparatively few schools have grounds large enough to allow space sufficient for carrying on much garden work, and few teachers feel competent to undertake the work. Of the latter, who might do something along this line, fewer yet are actually attempting it. But they can scarcely be blamed for their apparent indifference. As we all know, teachers who do their full duty usually have all that they can comfortably attend to, without annexing extras, for which they are neither employed nor paid. But, on the other hand, the efforts of those who have sacrificed much, in order to afford their pupils the pleasure and profit of such work, in most instances are reported as having been successful. They insist that it is well worth while, and deplore the fact that comparatively few teachers are interesting themselves in it.

If the school garden movement is ever to become general, it will be by much the same methods as those adopted in the beginning of the nature study movement, which have brought a gratifying degree of success to the latter. Interested teachers, here and there, will have to take up the work with such conveniences and helps as may be available to them, beginning in a small way, and undertaking more as their experience broadens. The movement cannot be made popular by any formal administrative orders, even if any school officials were unwise enough to demand the introduction of the work. However, it is too often the case that trustees or superintendents are too indifferent to give the work proper encouragement and support, where conditions are favorable for it, and teachers are willing to conduct it.

The writer believes that the future of the school garden depends upon those earnest, unselfish teachers who are willing to do much for which they can hope to receive no direct financial return. The school garden seems destined to be one of those "extras" for several years to come. It therefore rests with the teacher who recognizes the opportunity, to develop in the minds and hearts of her pupils the sort of sentiment that naturally paves the way for such work. Let her begin by arousing a generous amount of civic pride in her charges. She may organize them, in some masterful way, for the purpose of cleaning up the school-yard, and then encourage them to do the same with their home surroundings. This would naturally be followed by a little well-selected planting about the school buildings or grounds. Then, having aroused the interest of the children in improvement work, generally, the teacher may introduce the subject of school gardens with the assurance that it will meet with their hearty approval.

It may be that the teacher will be able to make arrangements with the school officials for having the garden work made a part of the regular school program. It might well be made to occupy a part of the time ordinarily given to nature study. But it will probably be found necessary, in practice, to do some after-school work, to make a success of it. As this offers a decided change in the nature of the work of both teacher and pupil, it should not prove tiresome. Of course where the work is not given any time on the regular program, it will have to be optional with the pupils, as well as with the teacher; and this has its advantages, insuring an interest on the part of all who participate in it.

THE RURAL SCHOOL VIEW-POINT. Probably the weakest point in the curriculum of the rural school, at least until very recently, is the fact that it has steadfastly ignored the natural environment of the country child. The school did practically nothing to interest the child in his environment, and the general trend of the work was really away from the country, and towards the city.



(Courtesy of Charly Organization Society.)

Fig. 2.—Unwholesome Environment For Growing Children



It is little wonder that the patrons of the school, in most cases, took little interest in the way the school was being conducted. To them it appeared foreign to their immediate interests, although perhaps a certain amount of pride persuaded them to support it, though all too inadequately.

The past generation has witnessed a great change for the better. The rural school is gradually establishing more points of tangency with rural interests. The school garden and other phases of agriculture are not only giving the child a broader and more sympathetic view of his father's occupation, but the parents are becoming more interested in the schools. Each is now endeavoring to make the work of the other more effective. The school garden is succeeding in its efforts to interest the child in his environment, by teaching him to observe and experiment, and thus learn for himself how knowledge, generally, is obtained.

Fortunately, the rural school may usually have a garden, so far as available land is concerned. It only remains for the teacher to take the initiative and secure the interest of a few of the more influential people of the community. In many cases, owners of land near the school-house have gladly donated sufficient land for the purpose, and perhaps plowed it gratis.

THE URBAN SCHOOL VIEW-POINT. Here the purpose of the school garden, if indeed such is possible, is obviously quite different. The educative value, as distinguished from the practical value of the country school garden, must hold first place in the minds of those planning and conducting the work. It is likely to prove a veritable revelation to many pupils, by giving them an outlook upon some important phases of that occupation which clothes, shelters and feeds them.

The garden should also, as in rural schools, inculcate a love for nature; and a desire to spend at least a large part of one's time in the country will be a natural result. Broadly viewed, this alone should justify the expense incidental to this work, since it tends to check the unfortunate stream-

ing of the country people into the already overcrowded cities. We are hearing a great deal now-a-days about the increased cost of living. No doubt trusts and combines of various sorts are doing their part to raise the prices of the necessities of life; but it is believed by many far-seeing men that a dearth of productive power in the rural communities is responsible for no small part of the trouble. The world is in need of more real producers. Cheaper raw materials and more of them, are what we need today as perhaps never before, and to secure these more people must be willing to work and live in the country, and help produce them.

Whatever the viewpoint,—rural or urban,—the school garden should serve as a centre about which much of the more formal work of the curriculum may profitably arrange itself. This correlation is especially applicable to such subjects as arithmetic, manual training, written expression, geography, and art. This idea has been carried to a considerable extent in some schools; it may be, however, that there is a little tendency, in some cases, to over-work it.

WHEN TO START THE SCHOOL GARDEN.

California has such a wide range of latitude and climate, that only a few general suggestions can be made on this subject. It will perhaps be sufficient to state that where citrus fruits cannot be grown successfully, on a commercial scale, the garden had better not be started until spring, when danger from hard frost is past. This will make it practically impossible to bring the slower-growing crops to maturity while school is in session. It may be done, however, in some cases, by starting the plants in boxes indoors, and transplanting them into the open, as soon as it is safe. This may easily be done, and it would prove to be instructive.

In Southern California, gardening is carried on every month in the year. However, it is recommended that school gardening be not started until late in October, because the early fall is usually too warm for doing the work with comfort. Some prefer not to begin work until late February, because many plants are found to grow so slowly during the

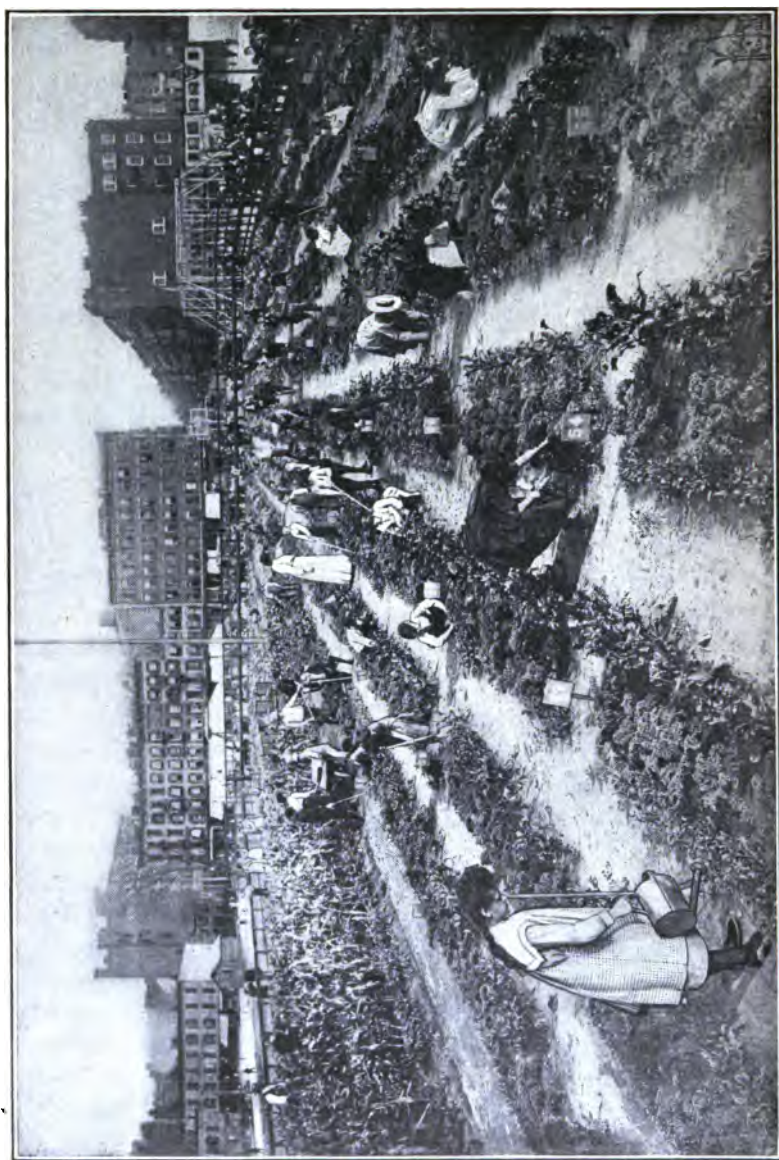


Fig. 3—Wholesome Environment For Growing Children

winter. But it seems to the writer that planting in the fall has much to recommend it. The pupils are given that much more time for practice and experimentation, and by the time good growing weather comes in the spring, are better prepared to take up the work in earnest. Moreover, if proper selection of seeds is made in the fall, the pupils can raise two crops of radishes, one of carrots, lettuce, and other rapidly-growing vegetables, before the first of March.

LOCATION OF THE GARDEN. Many schools do not have grounds large enough for necessary play room, not to mention the setting aside of a space for a garden. In many cases this difficulty has been obviated by securing the use of a near-by vacant lot. Of course the question of an abundant supply of water is very important. It is quite likely that in most such cases, connections with the water main could be made at little expense. Where possible, other conditions being favorable, the garden should be located in a sunny place, and the soil should be as good as can be obtained. At the side or rear of the building would be a more suitable place than the front. In some localities, it will probably be necessary to have a fence built around the garden to keep out stray animals. Dogs and cats sometimes prove quite an annoyance to the young gardeners, especially when the seeds have just been planted.

COMMUNITY VERSUS INDIVIDUAL PLOTS.

Each of these has its advantages and disadvantages. An ideal arrangement would call into use some work in each. The community plot is usually better for the youngest pupils, because they are not old enough to care properly for plots of their own. In them the pupils are taught the important lesson of harmonious co-operation, no easy acquirement. Many adults have apparently never really learned this lesson.

On the other hand, the individual plot alone can give training in responsibility and independence. Here successes stimulate the youthful gardener to greater effort, and fail-

ures demand of him explanations. Property rights teach the privileges and responsibilities of ownership, and above all, the great lesson of respect for the property of others. This is logically the only way of teaching the lesson. The child who has never possessed a thing as the result of his own efforts, cannot appreciate the difference between "mine and thine."

The instinct for obtaining possession of property is so strong in older children, that it is often difficult to interest them in a community affair. This is because they have not yet learned to overcome selfishness by a spirit of altruism. But it must be recognized that this they must eventually learn to do, and the sooner the better.

Where feasible, it is well to have each pupil work his own plot independently, and in addition, let the class care for a community plot. The latter should have some special feature to recommend it. A class might, for instance, plant a garden having in it the commoner representatives of a certain family. The mustard family would be represented by radish, turnip, cabbage, cauliflower, kohlrabi, candytuft, alyssum, etc. The nightshade family, also, would afford an interesting study.

TOOLS. Only a few different kinds of tools are needed for gardening; the number of each will depend upon the operations to be performed, and the number of pupils who are to be engaged in the work at one time. For the rough preparation of the soil, where this is to be made by the pupils, the best tools are the spading fork and the two-pronged grape-hook shown in the accompanying illustration. If the ground is very hard, the latter tool would not be suitable, and the fork enables one to loosen the soil to a greater depth, though it is slower work than with the other tool. A spade is very useful about the garden, and almost a necessity, but it is much harder to use than the fork, in loosening the soil. These tools would cost a school about as follows: the spading fork, \$.65; grape-hook, \$.80; spade, \$.80.

The rougher preparation of the soil having been finished, the rake is the next tool needed. The bowed rake will prove the strongest, and one with about ten teeth is fully large enough for any ordinary purpose. For general work among plants, at school or at home, the writer knows of no other tool so handy as the so-called combination tool. The four-toothed form, costing about half a dollar, is more easily handled by the lower grade children, while the six-



Fig. 4—Tools Used in The Garden.

A, 4-toothed combination tool; B, spading fork; C, 6-toothed combination tool; D, double-bowed rake; E, grape-hook; F, spade; G, single-shanked rake (not so strong as D); H, 5-toothed rake; I, hoe; J, sprinkling can; K, trowel; L, M, N, hand-weeders (M is much the best).

toothed one is more serviceable in the hands of older pupils, and costs but little more. The three-toothed hand-fork (fig. 4) is the best small tool, and may be bought for about 30 cents. The prices given for the above mentioned tools, are for the best quality only. It is short-sighted policy to buy a cheap grade of tool, especially for children. They are quite likely to subject them to many unnecessary strains, which soon result in the destruction of all but the toughest.

If the school is not yet in a position to purchase the necessary tools, the teacher will have to appeal to her pupils for such as they can bring from their respective homes. This is the only tool supply available in the case of many schools doing good work, at the present time, and an interesting collection it is, too; but they do the work, and that is what is wanted.

CARE OF TOOLS. Whether the tools used by a pupil are his own property, or belong to the school, it would be an unfortunate sort of training that would allow him to put them away with mud on them. As a rule, the soil should not be worked when it is moist enough to stick to the tools, but this is sometimes likely to occur, and then they should be cleaned, before being put away. A tool-house or locker is a good place to keep them in, and they should be put away in an orderly manner. If they can be hung up, in definite places, so much the better.

GENERAL PREPARATION OF THE SOIL. Where feasible, it is better to have the whole garden plowed deeply and harrowed, as this relieves the children of much hard work, and it is done more thoroughly than they will do it. If they are to do the work, the spading fork will probably be the best tool for the purpose. Any coarse material, like sticks, stones, etc., should be carted away. If the soil is too compact, mix thoroughly with it liberal quantities of sand and manure. Adobe soil is also greatly improved by working into it an application of air-slaked lime. Sandy soils require plenty of manure to increase their fertility,

and improve their water-holding power. Finally, the rake is to be used in levelling the surface, and in pulverizing the soil.

PLOTS AND WALKS. The teacher with her pupils may now measure the space to be given up to the garden, as a lesson in practical arithmetic. Then they may discuss the manner of laying out the plots and walks, and make any other plans concerning the proposed work. Thus the pupils will take a lively interest in it, because, having helped to plan it, it is more truly their garden. If just as convenient, the plots would better be arranged so that the rows will run north and south. This affords a somewhat better distribution of sunlight. There being abundant ground, the main walks should be four or five feet in width, and the paths between the plots about two feet wide. The width of the plots may be four or five feet, with any desirable length.

Where economy of space is an important consideration, it would be well to lay out the garden in large compound plots. This was done at the Los Angeles Normal School, the plots being made eight feet wide and about thirty feet long. These plots were carefully staked out, and edged with one-half-inch redwood battens, four inches wide, a like strip being placed through the center of the plot lengthwise. Such a plot is worked by an even number of pupils, half of whom are arranged along each side, and care for individual plots four feet wide. Because of the rapidity with which small individual plots dry out, the writer is of the opinion that this scheme is worth trying, even where there is plenty of ground. The corner plots are exposed on but two sides, and the inside plots have only one side to protect against drying. It would seem that this is of sufficient advantage to compensate for the slight disadvantage of being obliged to do most of one's work from one side. Of course many schools would not feel that they could afford the expense of edging the plots, but it is not necessary in carrying out the idea of segregating the plots.

In order to conserve moisture, the plots should be dug out so as to leave them a little lower than the walk will be, when it becomes packed by use. If the soil removed is distributed over the path, this will not be a very arduous undertaking. The sunken plot is more easily watered, and retains its moisture much longer. Moreover, with such an arrangement, it is a simple matter to water by the trench method. Another way to water economically, as is being done in some cases, is to dike soil about the edges of the plot, just before sprinkling.

ASSIGNMENT OF PLOTS. Having decided how the plots are to be arranged, the teacher may next make a working drawing embodying the details, and assign the plots in some definite order. If the pupils are old enough for such work, it would be a good idea to have each measure his own plot, and draw the same to a scale. In order to stimulate the youthful gardener to take the best care of his plot, it is suggested that each put up a neat sign bearing the name of the owner of the plot. The pride thus appealed to is often of advantage.

THE GARDEN NOTE-BOOK. This should be kept as a sort of diary of garden operations and observations, if the pupils are not too young. The book may be of pocket size, and the first record should be the plan, showing the proposed planting. Then may follow a description of the process of the preparation of the soil, the laying out of the walks, plots, etc. It is especially recommended that careful records be made of dates of planting seeds, and the time of the seedlings' appearance. Later on, the class can average their results, as a part of their arithmetic lesson. How far it will be wise to carry this idea of note-taking must be determined by the individual teacher; it is quite possible to overdo the matter. It is suggested that the pupils sketch in their note-books the seed leaves of the various plants they grow, labelling each drawing.

SELECTION OF SEEDS. It would be well for the class to have for convenient reference some sort of planting chart, *giving the data which they need to know in making selection of the seeds they propose to plant. It should be posted in an accessible position, and the teacher would do well to have at hand several catalogs from seedsmen of her portion of the state. These frequently contain simple charts, and should be consulted often by both teacher and pupils.

Discuss flowers and vegetables suitable for planting, and help the pupils to make wise selections. Have each child plant both flowers and vegetables, and thus develop the esthetic as well as the practical side of his nature. As a rule, the more easily grown plants should, in a given case, be planted first. When these have been grown successfully, it is time to undertake something more difficult, or requiring a longer time for maturing.

Guard against any possible selection by the pupil, of seeds which are out of season, as the failure resulting would not only be disappointing, but might discourage him. It is allowable, however, for the pupil to plant certain interesting crops, as peanuts, sweet potatoes, or squash, even if they will not mature by the time school closes, if he understands this. In fact much interesting work of just that sort may well be done, especially by older pupils.

Finally, having decided what he is to plant, the pupil should record his selections upon his garden plan in the note-book. The teacher would do well to examine each plan, and permit no planting until it has received her signature.

PREPARATION OF THE SEED-BED. It is assumed that the rougher work of preparation has already been done. The pupil now needs a rake for the purpose of put-

*The writer has compiled both flower and vegetable charts for use in Southern California. These are published by the Los Angeles Normal School, and teachers may secure them by enclosing stamp with application for the same.

ting on the finishing touches, before planting the seeds. The last of this work should be done with the back of the rake, as it leaves the surface of the soil smoother. Make the plot as nearly level as possible, and have the soil as compact along the edges, and in the corners, as elsewhere; otherwise watering will settle it unevenly.

Some lumps are likely to occur, and these are best spaded under. Or, the plot may be sprinkled, and the lumps will pulverize a short time after. Do not, however, attempt to pulverize dry lumps of dirt, as the result will be a powdery mass which tends to puddle when next moistened, and later forms a crust. The average soil, when in a proper condition for working, is readily reduced to soil "crumbs," by use of the rake, and such a surface bakes very little. In burying the lumps, one naturally brings fresh soil to the surface, and this only is suitable for use as a seed bed. Unless the plots are lower than the walks, and are to be irrigated by the trench system, now is the time to dike the edges of the plots. It cannot be too strongly urged that the preparation of the soil for the seeds be given special attention, because the future results depend so greatly upon it. The soil *must* be loosened deeply all over, and be pulverized thoroughly for the best results; no amount of work, after the seeds are planted, will make up for poor preparation to begin with. Don't be in a hurry to plant seeds.

PLANTING THE SEEDS. The planting of small seeds should always be done in a seed-bed freshly prepared. Should the work of sowing be postponed until the surface becomes dry, it will pay to freshen it by sprinkling, and re-raking as soon as it loses its stickiness. For most of the smaller of our commonly grown plants, the furrows to receive the seeds should be ten or twelve inches apart. They may be made by using the handle of a hoe, guided by a string stretched between two stakes, or a narrow board may be laid down and used as a straight edge. See that the trenches are made of even and proper depth, and flush with the edges of the plots. As a general rule, seeds should be

planted, out of doors, to a depth equal to about four times their diameter. It will be seen that there is a likelihood of making the trenches too shallow, because the real depth is less than it appears.

It would be well to discuss with the older pupils at least, as a class exercise, some of the reasons for planting at certain depths. Although the rule varies considerably, it depends upon the following: (a) size of seed—smaller seeds having less reserve food; (b) character of soil—seeds should be sown shallower in compact soil; (c) amount of moisture in the soil—in a dry soil, sow deeper; (d) season of the year—sow shallower in cold weather, else seeds may decay.

Again, the number of seeds per foot of row, may be a good subject for discussion in the classroom. It is determined by the following: (a) percentage of viable seeds—seeds of low germinating power should be sown more thickly; (b) whether the plants may profitably be transplanted—if not, the extra ones are wasted; (c) nature and condition of soil—if the latter is cold, very wet or compact, sow more seeds.

Many seeds will germinate much more quickly if soaked in tepid water for several hours before planting, and when the soil is rather dry this preparation is advisable. If small seeds are soaked, it will be well to dry them externally, before planting, by pressing them between the folds of a cloth, and mixing with enough fine, dry soil to prevent them from sticking together. They are now sown according to directions. If the pupil has been careless about this, let him learn his lesson by picking out the extra seeds, one by one, or otherwise rectify his mistake. The teacher will doubtless discover, sooner or later, that it is easier to get a pupil to thin out seeds than the plants, and it is therefore suggested that she insist upon seeing the planted rows before the seeds are covered. It is also recommended that some sort of markers be placed at the ends of each row, to indicate its position, before covering the seeds.

The rows being properly planted, the seeds should be covered evenly with fine soil. The plan of mechanically filling the trenches with the soil forced out in making the same, is open to some objection. It is likely to contain some lumps, hence the furrows should be filled discriminately; and then, unless it is rainy weather, the soil should be well firmed over each row. This may be done by placing a narrow board over the same and walking over it, or by the blade of the combination tool. The object is to re-establish the capillarity of the soil, and bring the seed into intimate contact with it. In this way it will absorb moisture faster, and germinate sooner.



Fig. 5—Normal School Students Working in Their Plots.

Where the class doing garden work under the direction of a single teacher is large, it will be found better while sowing seeds, to work with only a few pupils at a time, if it can be so arranged. If there is nothing for the re-

mainder of the class to do, or if there is no one to look after them, they may better spend the time in playing, until the teacher can work with them. Almost any child will take interest in a garden which starts well, but to secure an encouraging start, the seeds must be planted under some supervision, and in well-prepared soil. The teacher cannot afford to hazard the interest which pupils generally take in this work, by allowing the latter to perform these most important operations carelessly; and few children realize the importance of doing such carefully.

Where space will allow, it is advised that the teacher prepare, plant, and care for a plot of her own, using it to demonstrate the various operations. Such a plot should serve as a model for her pupils, in all features that may profitably be imitated. In lieu of such a model, the teacher may well demonstrate her ideas by the use of the plots of different pupils, the class looking on from one side.

CARE OF PLANTED PLOTS. Any operations performed after seed-sowing, and before the seedlings appear, are for the purpose of hastening germination. The chief concern is to insure sufficient moisture to bring this about. The small, shallow-planted seeds, especially, require care to keep the soil moist, and daily watering will be necessary unless something is placed over the rows to prevent undue drying. For this purpose, one may use boards, burlap, papers, etc. They should be removed promptly, however, as soon as the seedlings appear above ground. At this time, one is quite likely to have the depredations of small birds to contend with. They are fond of the tender seedlings, and the latter will need protection for a few days. Sometimes a scare-crow that flutters its tatters in the breeze will perform efficient service, but more often it becomes necessary to cover the young plants with mosquito netting. In this case, it is best to support the netting, keeping it away from the plants by means of sticks placed in the ground temporarily.

The sooner the ground between the rows is cultivated, the better, since this helps to retain the moisture. Unless

the children are quite young, this may begin at once, the markers serving as a guide to indicate the positions of the rows, and the combination tools being used. But do not work any soil over upon the planted rows. It is a good idea to scatter a few radish seeds along each row with the other seeds; they germinate very quickly, and show the positions of the rows, so that one can cultivate more safely.

It frequently happens that the tender seedlings have much difficulty in breaking through the crust which forms at the surface of the soil. In such cases, a little deft work with the fingers,—removing lumps or stones,—or gently breaking the crust into smaller pieces, will greatly assist them. It might help, also, to pour water gently along the cracked soil, where they are trying to break through.

WATERING THE GARDEN. This is one of the most vexatious of the problems to be solved in connection with school gardening. Here, theory and practice are likely to conflict. One cannot always do in the school garden what one would ordinarily do at home. There are two general systems of watering.

(a) *THE TRENCH SYSTEM, OR IRRIGATION PROPER.* This is the system generally used in all artificial watering carried out on a large scale. It is usually spoken of as irrigation, and by it the largest amount of water is absorbed by the soil, with the least relative loss from evaporation. By the use of the trench, water may be transported to considerable distances from a hydrant, and where it passes through a portion of the crop, there is little actual loss. Again, since the foliage of the plants is not watered, there is a considerable saving over the sprinkling method. Moreover, it is practically impossible to get sufficient water to deep-lying roots by the latter method.

But where watering is to be done on a small scale, the trench system may be impracticable. To do it properly, one has to take plenty of time, and needs to dress for it, because, though interesting work, it is likely to soil one's clothing.

It is recommended that the method be taught to the pupils, but how often it is to be actually employed must be determined by the individual teacher. It would perhaps be well to plan one series of plots, or a strip along the border, for practice work. The plots may be arranged in a double row, with about a foot of space extending along the center, lengthwise, in which to establish a trench. The water may be allowed to run into the upper end of the latter, and the pupils should make their individual canals along the alternate spaces between the rows.

When the soil seems to have taken all it will readily absorb, turn off the water, and dam up the small trenches in order to hold what they have. As soon as feasible, they should be closed and the surface left in good condition for retaining the water. If it does not seem best to use the main trench, the pupils can simply excavate and fill small ditches dug along alternate spaces. On the whole, it would seem that this method should largely prevail. Until the seedlings are well established, however, it is best to water by sprinkling.

(b) *SPRINKLING THE GROUND.* One of the difficult problems in connection with this work, is to decide whether the plots are to be watered by the pupil, or by some one employed for the purpose. This has to be decided on the merits of the case, but it is better if the pupil can do a large portion, if not all, of the work required in connection with his plot. If he is to sprinkle his own plot, substantial two-gallon watering-pots should be provided for the purpose. The rose may be removed to advantage, as soon as the plants are large enough not to be injured by the rougher method.

(c) *WHEN TO WATER.* When one is left free to choose, evening (with a few negligible exceptions) is the best time to water one's plants. The work may then be done with comfort, and with the least loss of water by evaporation. Give the soil all the water it will readily absorb, and early the next day cultivate the surface to retain the

moisture. The sooner this work is done after watering, the better, only one should not attempt to do anything with soil so long as it remains sticky. Otherwise the tools will become clogged with mud, and the soil upon drying will be left in a lumpy condition. On the other hand, if the soil is watered while the sun is shining brightly upon it, a crust is very likely to be formed. But it is sometimes impossible to avoid this, as when one transplants at such a time, the plants must be watered promptly. Water only when it is necessary, and then do it thoroughly, making sure that it has gone down well into the soil. As the surface soil dries out first, it is necessary to water the smaller or shallower-rooted plants oftener. The amateur may determine when it is time to water his plants, by digging down into the soil, a little distance from a plant. The latter will usually not suffer so long as the soil is moist enough to pack in the closed hand.

THINNING OUT PLANTS. This is a very important task, but one which the pupil is brought to do, only with difficulty. He does not like to up-root any of his plants; however, it is a logical punishment for those who sow too thick. This work should be done as soon as the true leaves appear. Remove the weakest seedlings, being careful not to disturb unduly the roots of the others. This might be obviated by simply pinching all the tender stems of the weaklings at the surface of the ground.

In the case of such plants as lettuce, beets, cosmos, etc., which may be transplanted profitably, remove the extra plants more carefully. Let the pupil take the latter home, and transplant them there, or give them to some one else. Here is a good opportunity to teach economy; the pupil should never be allowed to destroy anything which would be of value to another. A dozen seedlings, a month old, may well be that much gain in time to somebody else who would be glad of them.

INJURIOUS INSECTS. *Plant lice* are among the most common of garden insects, and are more often found

upon the larger-leaved vegetables, such as cabbage and chard, although flowers, too, suffer from their ravages. An unhealthy appearance of the newer growth should lead to an investigation, which will probably bring to light a flourishing colony of "green flies." The same plants are often over-run by ants, which are attracted by the "honey dew" secreted by the plant lice. In fact, the presence of ants may be regarded as an indication that the latter are near by. The ants probably do more good than harm, in this case, but the plant lice should be thoroughly sprayed with one of the proprietary insecticides for sale at the seed stores.

Cut-worms are another source of trouble to the gardener. Their depredations consist in cutting off the stems of smaller plants, at the ground, or in eating the foliage of larger ones. They feed at night, mostly, and hide during the day in the axils of the leaves, under objects, or in the soil about the stems of the plants. In any event, they should be found and promptly despatched. Slugs, too, feed at night, and may be located on the under side of the lower leaves, or under lumps, stones, etc. Their presence is often indicated by the slimy path left behind them as they move about.

DISCIPLINE IN THE GARDEN. Where school gardening is optional with pupils, there will of course be no real discipline entering into the question of getting a reasonable amount of work done. Besides, the latter would most likely be done outside of school hours. But in case the whole class is taken to the garden for work, and the teacher has a score or more of pupils to manage, it may prove something of a problem. The wise teacher will lay her plans carefully before leaving the classroom, and thus assure herself that her pupils know what she expects of them. Much of any confusion or inattention entering into the work is due to lack of such organization, and it cannot easily be corrected after the class has begun its outdoor work for the day.

The pupil must be taught to distinguish between the liberty which is natural in such work, and the license to waste his time, or prevent others from doing their work properly. There is no reason why he should not be required to attend to business as strictly in this, as in any other required subject; though the nature of gardening frequently permits greater freedom of activity, and it requires considerable judgment to know just where to draw the line.

The Lath-House

USE. This very useful structure is a necessary adjunct to any sort of plant-rearing enterprise which is at all extended, and is certainly a desirable acquisition to anyone who enjoys working with plants. It affords a place where one may work in comfort in the hottest weather; and moreover, in the lath-house one can undertake to do work of certain kinds that if attempted without it would result in discouragement. The expense of a small structure, large enough for home or school use need not be prohibitive.

The chief use of the lath-house is to shelter and protect such plants as require plenty of shade and moisture for their best development. In practice, it serves as a store-house and hospital for ferns, palms, and more tender plants of all sorts. It may also have a potting-bench, and accommodate flats of seedlings of such plants as are unsuited to outdoor culture,—for the time, at least,—as well as for hardening off plants which are to be put outside. The cutting-bench too, may be located in the lath-house, except, perhaps, in the coldest weather.

LOCATION. The lath-house should be so located that one can look after the plants with as little inconvenience as possible. If practicable, water should be piped into the lath-house; if not, it should be easily accessible. The structure should preferably run east and west, and not be shaded to any extent by other objects.

STRUCTURE. The lath-house is usually of a rectangular shape, and with a flat or slightly arched roof. If it is to be built nearly square, and not very large, the plan might well include a bench around a central support, with a path surrounding this, also serving an outside bench. But if it is to be only about seven or eight feet wide, the path may occupy a central position, with a bench on either side. For a small structure, the latter is recommended.

The frame should be built of redwood material; the uprights of 2x4s, and the cross pieces of 1x4s. The height need not exceed $7\frac{1}{2}$ feet, and all laths should be set at a distance apart not greater than their width; some space them at a less distance. However, it is of fully as much importance that the laths of the roof run north and south. This is for the purpose of securing the best distribution of sunlight. With this arrangement, a given portion of a plant is alternately in sunshine and shadow. The sides may be lathed vertically, or at an angle of 45 degrees, and the structure would better be entirely enclosed. This is necessary to keep out small birds, which are likely to prove an annoyance, if one has small seedlings accessible to them. A base-board, about ten inches high may be extended around the lath-house, converting the inside spaces under the benches into handy storage bins. Along the north or east side would be a suitable place for a row of smilax or *Asparagus plumosus*, which could be trained up on strings tied to the roof.

A good width for a small house is about 7 feet. There may then be a bench 2 feet wide on either side of a central walk, which is a yard in width. These benches should be made of one-inch redwood, supported every few feet underneath by 1x4 cross-pieces nailed to 2x4 legs. The bottoms of the benches should be about 30 inches from the ground, and have three-quarter-inch holes bored not more than a foot apart, for drainage. Then they are to be provided with side and end pieces converting them into large boxes about four inches deep.

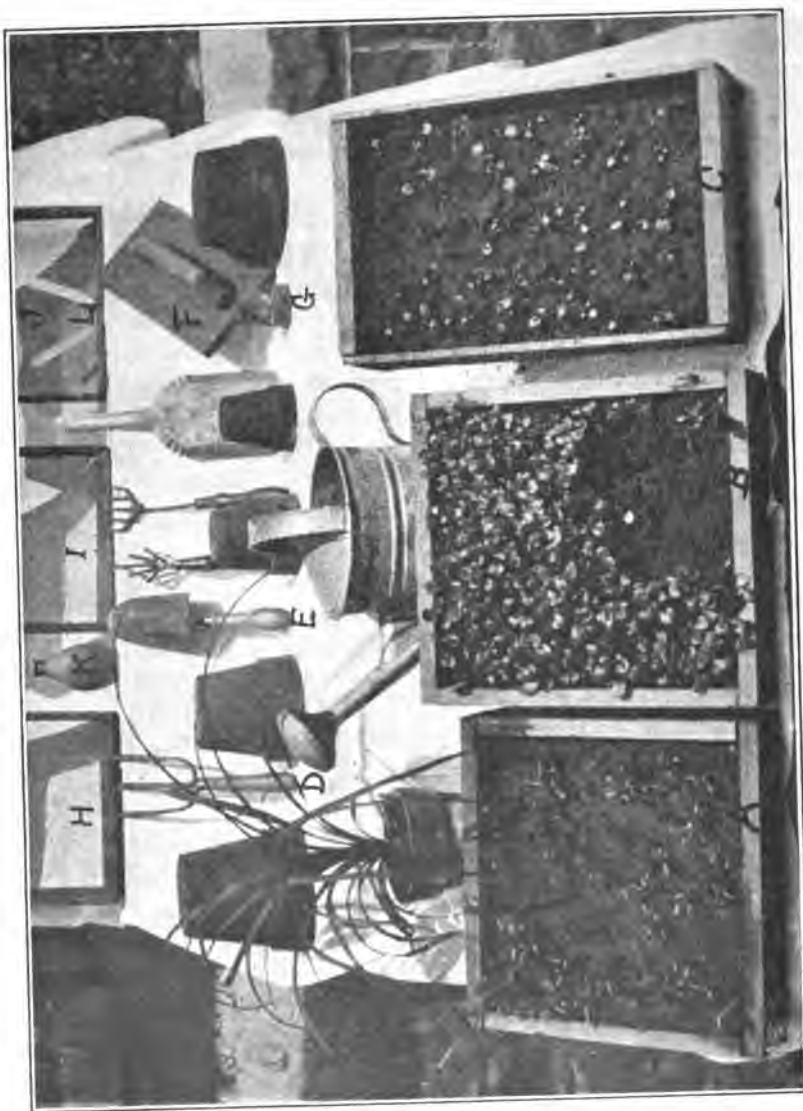


Fig. 6—Some Lath-house Equipment.

A, young tomato plants; B, flat of pansies which yielded over 200 plants; C, some of the plants transplanted from B; D, hand-fork; E, trowel; F, float used for firming soil; G, thumb-pot; H, I, J, screens of $\frac{1}{4}$, $\frac{1}{8}$ and 1-16 inch mesh, respectively; K, Scollay sprinkler, used in watering fine seeds; L, plant labels.

Under the benches may be kept soil, compost, sand, extra boxes, plants, etc. Ferns, *Tradescantia* (wandering Jew), *Selaginella* and the like would be suitable for the shadier side. One of the benches may be given about an inch of coarse gravel, and on top of this about three inches of moderately coarse sand, to be used for rooting cuttings. The other may be used for potting work, seed-sowing, or anything else. Fine sand is not so good for cuttings to "strike" in, because it retains too much water, thus preventing proper aeration.

A lath-house, such as is here described, and about 7x10 feet, may be built for about \$21. This includes both materials and labor, and a Yale lock for the door.

EQUIPMENT. If the lath-house walk becomes unpleasant in wet weather, this may be easily remedied by laying an inexpensive slat-walk. Simply nail 1x3 redwood strips, one inch apart, to a couple of 2x3 pieces laid lengthwise. Such a walk would make the work in the lath-house less dirty at any time, because any watering is likely to leave it more or less muddy, except in the case of sandy soil.

There should be at least one large square-pointed shovel, with sides turned up a bit; and a few small galvanized iron shovels, costing but a few cents apiece, would be very useful, where several are to work in the house at a time. A few trowels and hand forks are frequently of use, and only the better grades of these tools are recommended.

The "flats," or shallow boxes—about 3 in. deep—which are commonly used in growing plants, may easily be made by anyone who is at all handy with tools. They should be of convenient size for handling, and often one can get empty grocery boxes which need only to be made shallower, and have a few $\frac{3}{4}$ in. holes 6 in. apart, bored in the bottom for drainage, unless there are large cracks. The "floats" which are used to level and firm the soil in the flats, are merely pieces of inch material about 5x7 inches, sawn true, and

with some sort of handle along the middle of one side; a knob or cleat will do.

Where seed-sowing is to be done, at least one good soil sieve is almost indispensable, and two or three sieves of different sized meshes would prove useful. The sizes most used are quarter-inch and eighth-inch mesh; the sieves may be made by fastening the common galvanized iron netting, kept at hardware stores, to small box frames. Use small staples for this work, and do not allow the screens to be used for other purposes, as carrying large amounts of soil, or pots. A finer sieve may be made by using wire mosquito netting, and in sowing some of the finest seeds a flour sieve is very helpful.

Flower-pots of several sizes are useful, and not very expensive, costing about as follows, per one hundred: 2½ in., 80c; 3 in., \$1.10; 4 in., \$1.50; 5 in., \$2.70. Where these cannot be afforded one may make use of empty tin cans, which are usually to be had in plenty. Be sure to punch holes in the bottom, before using. The ragged tops may be melted off very easily if the cans are placed on a hot stove with the tops down. Neat little wooden plant labels, costing about one dollar per thousand, are convenient, but these, too, may be dispensed with.

Seed Sowing in Boxes

Many seeds which do not germinate nor grow well in the open ground are sown in boxes, and cared for in the lath-house, or under other protection. The seeds of certain plants like dusty miller, Lobelia, and Begonia, are too small to contend with the unfavorable conditions out-of-doors. Others, as *Asparagus plumosus* and many tree seeds, germinate very slowly, and require constant moisture. Again, certain tender plants like *Cineraria*, tomato, and pepper, are started inside in the cold weather, and set out-of-doors when danger from frost is over.

The seed-box enables one to make a better preparation of the soil, to sow and cover the seeds more evenly, to provide a more continuous supply of moisture and more effectively to protect the seedlings from unfavorable weather and birds.

THE SOIL. This should be sandy enough to allow of ample drainage, and yet contain sufficient organic matter, or humus, to enable it to retain moisture well. An intimate mixture of equal parts of garden loam and sharp sand will prove of good general use. When properly compounded, and only fairly moist, such a soil will not pack much when squeezed in the hand, and will not bake on the surface, if exposed to the drying action of the sun.

PREPARATION OF SEED-BED. Always be sure that the flats to be used have sufficient openings in the bottom to insure perfect drainage. Put about an inch of coarse material in the bottom, and screen on top of it, through quarter-inch mesh, enough soil to fill the box to within an inch of the top. Now shake it down nearly level, and use the float to insure uniform compactness. One has to be especially careful to firm the soil along the edges. The surface should be level and of even distance below the edges of the box. Now prepare the final seed-bed by putting on a layer of finer soil, about half an inch deep. For most seeds, the one-eighth inch mesh will do; but if very small seeds are to be sown, a mosquito netting or flour sieve will be better. The box must not be filled level full of soil, and if the seed-bed is very far below the top of the box, the seedlings may become spindling; half an inch is a sufficient distance.

If the soil to be used for this work is not already moist, it should be watered and well mixed before it is put into the box. It is a difficult matter to moisten properly a box of dry soil, without disturbing the planted surface, except in the case of large, deeply-planted seeds.

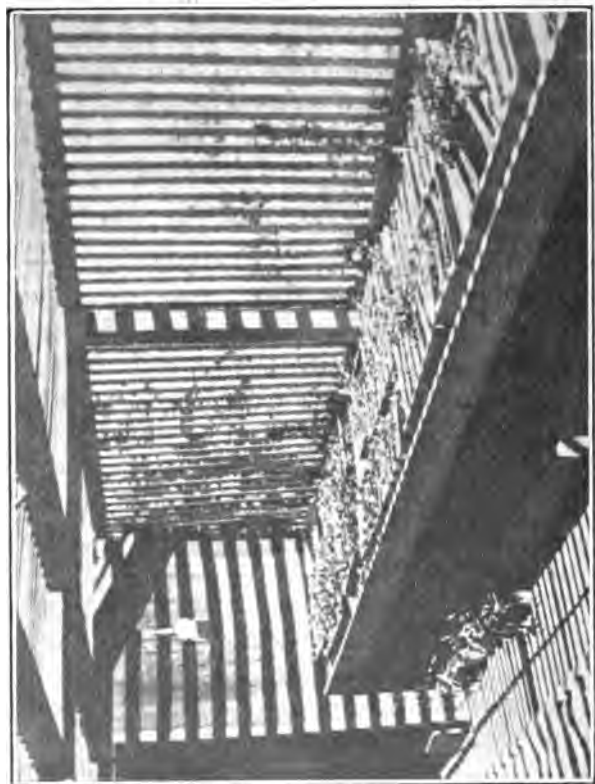


Fig. 7—Portion of Lath-house Showing Flats of Seedlings.

SOWING THE SEED. Shake the seeds down into the end of the envelope which bears the name and tear off the other end. Now carefully scatter them over the surface, as evenly as possible. Do not sow very thick, because undue crowding will result in a failure of all but a few of the plants to grow large enough to amount to anything. Where seeds chance to lie too thick, it will pay to separate them, by the use of some small object, as a match. Large seeds like *Asparagus Sprengeri*, may be sown in check rows, about an inch apart, and pressed into the soil with the finger.

The seeds should now be covered evenly with a layer of soil about equal to their own diameter. Use the same screen as before, and watch the operation as it proceeds. As one cannot safely redistribute the soil now, he will have to manipulate the screen or the center will receive too much, and the edges too little soil. To obviate this, give the screen more range, by carrying it well beyond the edges of the flat; often a little soil may be rubbed through the screen held over the spots where the seeds show. A good method of sowing tiny seeds is to mix them intimately with several times their bulk of fine, dry soil, and broadcast the mixture.

The float may now be used to firm the surface of the soil. This prevents the seeds from being washed out in watering, and bringing them into more intimate contact with the soil, hastens their germination. In the case of the smallest seeds, although no soil of any amount is sifted over them, the float is also used, and for the same reason. The boxes should be cared for in the lath-house, or other shaded location, until the seedlings are large enough to transplant.

LABELLING THE BOX. It is usually well to label each flat as soon as it is planted. For this purpose, one should write the name in pencil only, upon one of the little wooden labels, bought at seed stores, and thrust it through the empty envelope into the corner of the box. The advantage of thus preserving the original name is apparent, but a twig

may be used in place of the written label. The latter may also contain the name and date of planting. The writing should be done in a round full hand, beginning at the blunt end.

WATERING THE BOX. The first watering is now in order. This should be done thoroughly, with a watering pot having a fine, well-fitting sprinkling attachment. One should not allow fine sand to accumulate in the sprinkler, and the "rose" should be protected from being marred. In sprinkling, do not flood the surface, else the seeds may be displaced. Apply the water with a swinging motion, and wait for it to soak in, before applying more. Give the soil all that will be readily absorbed, and water as often as is necessary to keep it moist, doing it thoroughly each time. The frequency and care with which watering must be done will depend upon how deeply the seeds are covered, and the rate at which the soil loses moisture. Those boxes containing very small seeds should be given extra protection; they may be covered with burlap or glass. In warm weather, watering must be done at least once a day.

DAMPING-OFF FUNGUS. This is the name of a common disease which attacks seedlings, causing them when very small and tender to rot off at the surface of the ground. It is a fungus which seems to develop rapidly during wet and cold weather. One can best guard against this disease by judicious watering at such times. The boxes should be protected from the rain, and by being watered only enough to keep the seedlings from wilting, the stems will in a few days have hardened enough to be able to withstand the attacks of the fungus.

Weeds are usually the first plants to appear in any seed-sowing work, and these should be identified as soon as possible, in order to be taken out of the way of the other plants. If the seedlings tend to become "leggy," or spindling, it is a sign that they stand too close together or need more light. At any rate, the latter will do no harm, if

sufficient water is given them, and may make the plants more stocky.

Transplanting

This term is used to indicate the operation of removing a plant from one soil to another. The degree of the resulting shock will depend upon the amount of actual injury to the roots or stem, and the amount of change in environment.

The soil from which the plants are to be taken, and that which is to receive them, should always be moderately moist at the time the work is done. Any watering necessary to put the soil in good condition, should be done long enough beforehand to allow it to lose its stickiness. As a rule, transplanting may be more safely undertaken if one accustoms the plants to a meagre supply of water for a couple of weeks before the operation.

The first leaves which appear above ground when a seed germinates, the seed leaves, though generally characteristic, do not resemble the true leaves. When the latter appear, it is assumed that the seedlings have become fairly well established in the soil, and when three or four of them have developed, the plants may be transplanted.

FROM SEED-BOX INTO OTHER BOXES.

Seedlings grown in "flats" are often transplanted into other boxes in order to give them a chance to become larger before subjecting them to the more trying conditions met with in the open ground.

Into the bottom of the flat put about an inch of coarse material, screenings will do, and then fill it to within an inch of the top with moderately rich, moist soil, run through a screen of one-quarter-inch mesh. With the use of the float, firm the soil uniformly over the top. Dig up the largest seedlings, with a little paddle or a blunt knife, being careful to leave as much soil on the roots as will cling to

them. Now lay off the surface of the soil into check rows, from $1\frac{1}{2}$ —3 inches apart, each way; dig the holes and set the plants, pressing them firmly into the soil. The distance between the plants of course varies with the kind of plant and the length of time it is to remain in the soil. They should be set but a trifle deeper than before, and the flat should be well watered and put in a shady place for a week or two.

In some cases it will be well to put a label in the box, and it is often necessary to afford the plants extra shading for a few days. One should water somewhat sparingly, after the first time, which is chiefly to settle the soil about the roots of the plants. The torn roots are thus given a chance to heal properly; excessive watering would tend to rot the tissue at the wounds. If well done, transplanting usually strengthens the plant by giving it a stronger root system.

FROM SEED-BOXES INTO POTS. Potting, though a little more expensive, has a distinct advantage over the method described above. Plants well established in pots can be transplanted into the open ground with little or no injury.

Small pots, "thumb-pots," are generally used for this purpose. The soil is screened as before. Soak the pots thoroughly before using, else they will rob the soil of its moisture, to the detriment of the plants.

Get together conveniently for work on the potting-bench, the prepared soil, with the flat of seedlings on one side and the empty pots on the other. Fill a pot about two-thirds full of soil, dig up a seedling, set it in position, fill in soil about it, and firm it in sufficiently to insure intimate contact between the soil and roots. This is best done by grasping the rim of the pot with the fingers, and pressing the soil about the roots, and against the pot, with the thumbs. The surface, however, should be left loose, and the plant should be in the center of the pot. Moreover, there should be left, at the top, a water-reservoir large

enough to saturate the soil; the pot should never be *filled* with soil.

Potting plants is painstaking work, if one would succeed with those which are not easily transplanted, but when once well learned, it may be done very rapidly. An experienced hand will pot several thousand plants a day. The recently-potted plants should now be well watered, and set in a shaded place for at least a few days. Subsequent watering will need to be done more often than in the case of plants set in boxes, because the pots dry out much faster than do flats. But this may be overcome by embedding the pots in sand or ordinary soil, until the plants are to be used.

FROM SEED-BOXES INTO OPEN GROUND.

This operation requires somewhat more care, since the change of environment is greater than in the cases discussed above. It would therefore be better to allow the seedlings to remain in the flats until they are a little larger. About two weeks before the plants are to be set into the open, the boxes should be put outside to "harden off." During this time, the watering must be gradually lessened, in order better to prepare the plants for the coming shock. Do not, however, allow them to become dry enough to actually wilt. If possible, do the work either late in the afternoon, or better yet, in cloudy weather. The soil to receive the plants should be spaded deeply, moderately fertilized if necessary, pulverized, and moist,—but not sticky. If the rows are to be more than a few feet long, a cord stretched between stakes may be used as a guide.

The plants should be watered at least half an hour before being taken from the boxes, which should be carried to the scene of operations. Remove the seedlings only as fast as needed, or at least do not expose the roots to either bright sunshine or a drying air for long at a time. If for any reason one cannot set out all the plants dug up, the leftovers may have their roots covered with moist soil, or be otherwise protected, and put in the shade. In this condition,

with some watering, most plants will not suffer for several days.

Dig the seedlings carefully, with as much soil as will stay on the roots, and set in holes as needed, firming only fine fresh soil well against the roots. If properly done, one can scarcely remove the plant by pulling at a leaf. It is usually well to remove some of the lower leaves from the plants as each is set into the ground. The rule is to reduce the leaf surface to correspond with the amount of root injury. The newly-set plants should be watered well, to settle the soil about the roots.

Amateurs, as a rule, do not realize the amount of root injury an average plant sustains when removed from the soil. The fact is, it is the very fine roots and root-hairs which are so easily torn off, that act as the chief absorbing organs, and these must be redeveloped before the plant makes further growth. The soil left in the bottom of a seed-box, after the removal of the plants, would convince the most skeptical of this fact; it will be found to contain a network of fine roots, binding the soil particles together. After such a view, one would not be likely to *pull* plants from the soil, when wanted for transplanting.

It is usually necessary to shade the seedlings for a few days, and this may be done in a variety of ways. One may use brush, straw, leaves, paper, weeds, shingles, burlap,—whatever is convenient. But nothing should entirely shut out the light for more than a few days at a time. The best shade is afforded by something that merely tones down the sunlight, without excluding the air.

There are two tools which will be found very helpful in the work of setting out small plants,—the trowel and the small three-tined hand-fork. The latter is a better tool for preparing the soil, while the trowel is needed to excavate a hole, and is usually better for use in digging up the plants. The fork is also a handy tool for general garden work.

TRANSPLANTING CUTTINGS. These are ready to be removed from the cutting bench, in which they are set

to "strike," as soon as they have formed roots about half an inch long. As these are likely to be brittle, one should use care in removing them from the sand. Do not make the soil to receive them very rich, because the cuttings are, as it were, in a convalescent condition, and even ordinary soil would mean a decided change in the environment of the young plant.



Fig. 8—Sixth Grade Children Potting Rooted Cuttings.
(Los Angeles Normal School)

A good method of handling cuttings is to pot them singly in small pots, in soil composed of equal parts of sand and loam, thoroughly mixed. Keep them in partial shade for two or three weeks, watering sparingly at first. Later, the

plants may be safely shifted into other pots, containing richer soil, or to the open ground. In the latter case, give them some shade, unless they have previously been exposed to sunlight. The point always to be kept in mind in handling plants, is never to expose them to a sudden change of any sort. But if accomplished by degrees, it is surprising to find how great a change a plant is capable of enduring with comparative safety.

OTHER KINDS OF TRANSPLANTING. The easiest kind of transplanting is that of plants well established in pots, and properly hardened ready for the new environment. In such cases, one can set out plants in Southern California at almost any time. The danger from frost is about the only drawback to such work. And since our nurserymen usually keep a large supply of potted plants of various sorts on hand, one may plant when he chooses; but of course there is some choice as to the best time for this work. As a rule, it is better to do as much as possible of it during the resting season of the different plants.

Where the plants are actively growing, it is well to cut back the tops somewhat, when they are set out, and shading for a few days might be advisable in some cases. Many of the larger plants are customarily established in discarded fruit-cans, and some advocate setting these into the ground with the plant. Of course the can will eventually rust away, and liberate the roots, but it is better to remove it. This should be done by cutting down through its side with a hatchet, when, with a little care, the root-ball may be removed with but slight injury.

In all transplanting of perennial forms, one should dig a hole considerably larger than the roots require at the time. Loosen the soil about the sides and at the bottom, working in rich soil if necessary. Set the plants but little deeper than before, and water thoroughly. Any plant of the size of an average rose-bush should have a basin left about its stem; this corresponds to the water reservoir left at the top of a properly potted plant. It is recommended that the

basin be nearly filled with some sort of mulching material, —leaves, straw, horse manure, shavings, lawn-clippings, or other litter. This will save the labor of excavating a basin each time of watering, and conserves the moisture. Moreover, if manure is used, fertilization is also accomplished.

In spite of some belief to the contrary, certain root crops among the vegetables will repay transplanting. In this connection may be mentioned beets and some kinds of turnips. Onions, too, may profitably be handled in this way. As in the case of the beet, some of the leaves should be removed, or the tops may be cut back.

FORETELLING THE COLOR OF THE BLOSSOM. In some cases, it might be desirable, when transplanting seedlings into permanent positions in the open, to be able to arrange them according to some color scheme. In the case of perennials, it would of course prove especially important. But it is not possible to foretell the color of the blossoms of any considerable number of plants. Nevertheless, one can do this readily in the case of a few of our common forms, and it is an interesting exercise for the teacher to conduct with her pupils. If one were to examine some young mixed seedlings of *Cosmos*, or snapdragon, he would find that the different individuals differ considerably in the color of their stems and leaves. Those having green stems will be found to produce light colored flowers—as yellow or white—and the ruddy stemmed seedlings will bear dark colored flowers. Something of the same relation exists between the color of certain bulbs, as hyacinths, and the color of the blossoms which they will produce. An investigation of the extent to which this is true with plants generally would prove an interesting study.

The Propagation of Plants

By this term we mean the increasing of the number of plants. There are two general methods of accomplishing

this, both of which man has learned by observing Nature's methods of multiplication. In the case of a given species, sometimes one of these methods only prevails, but many plants are easily propagated by either.

BY SEEDS. A seed consists of an embryo plant with sufficient food to enable it to establish itself in the soil. In general, seeds may be divided into two groups.

1. *ALBUMINOUS SEEDS.* These seeds have their food stored around the embryo, in which it is embedded. Good illustrations are seen in the seeds of corn, onion, and pine.

2. *EXALBUMINOUS SEEDS.* In this group, the nourishment is usually stored in the fleshy cotyledons, or seed leaves of the embryo. This is the case with beans, peas, squash, etc.

Most annuals and biennials are usually propagated by seeds. The latter are also our only means of producing new varieties at will. All plants produced from seeds tend to vary, and constant selection is necessary to prevent deterioration, or to keep the plant true to the type. But variation in seedlings is much more likely to occur when two plants of different variety or species are cross-fertilized, or when a plant ordinarily propagated in some other way, is grown from seeds. If one makes it a rule in propagating a plant to ignore the seeds produced by it, that plant not only gradually loses the power of seed production, but at the same time its seedlings become correspondingly unreliable. The tendency of seedlings to vary is undoubtedly due to the fact that they are produced sexually,—that is, by the commingling of two more or less distinct ancestors. It will be seen that a great variety of combinations of the characters of these is possible, depending largely upon the differences between the parents.

Thus we plant seeds when we wish to produce new varieties of plants like apples, peaches, oranges, dahlias, etc. But of course one cannot expect more than a small per cent

of such seedlings to prove valuable. A much commoner use, however, for fruit tree seedlings, is to serve the purpose of stocks which are budded or grafted to approved varieties.

BY DIVISION OF THE PLANT. Here a living bud, or portion of the parent capable of forming such, takes the place of the embryo of the seed. The resulting plant, in this case has no chance to vary, being in reality an independent portion of the parent. Valuable plants are propagated in this way, if possible, in order to perpetuate their characteristics. There are two general methods of propagation falling under the above heading.

1. *WHILE ATTACHED TO PARENT.* There is no critical stage in the case of this method, because the part which is to form a new plant is not severed from the parent until it has developed into an independent condition. One may often succeed with this while failing with other methods.

(a.) *BY SUCKERS.* These are shoots which spring up about the parent, from roots or underground stems,—as the blackberry, raspberry, lilac, etc. Roots develop promptly at the junction of the shoot and underground portion, and upon severing the latter on either side, an independent plant is obtained. By severely pruning the parent, a larger number of suckers may be produced. It would be well to prune the latter somewhat when they are transplanted.

(b.) *BY STOLONS.* These are slender branches which, bending down to the ground, take root near the tip, generally at a node. The process may be hastened by slicing off a little tissue from the node where one wishes the roots to form, and burying that part of the stem in moist soil. This is an excellent way to propagate blackberry, loganberry, and many of our perennial vines, and shrubs of straggling growth. Where none of the branches are long enough to root upon the ground, one may support some sort of re-

ceptacle upon a stake, and fill it with soil for this purpose; of course it must be kept moist. It is frequently advisable to place some sort of weight upon the soil, to hold the bent branch securely in place.

(c.) BY OFFSETS AND RUNNERS. These are really forms of the next above. The strawberry, "strawberry geranium," violet, and houseleek are common examples. The small plants are ready to transplant as soon as they have acquired a few roots.

(d.) MOUND LAYERING. This is practiced with currant, gooseberry, and similar bushy forms. The old growth is cut back to near the ground, and this results in the formation of a number of succulent shoots. Each of these should have a shallow v-shaped notch cut in its base, near the ground, and the clump is then to be mounded with dirt, which must be kept moist. Roots will form at the wounded places, after which the shoots may be severed below them, and the resulting plants transplanted.

(e.) BY DIVISION OF ROOT-CROWN. This is somewhat different from the above methods, but may as well be placed in the same category. It is the common method of propagation of Canna, calla, Caladium, Dahlia, Shasta daisy, bamboo, papyrus, rhubarb, Asparagus, and others. By breaking the clumps where they seem to part easiest, the least injury results.

2. DETACHED FROM PARENT. In these cases, the part is at once removed from the parent, and has to establish itself by forcing its own roots or stem, as the case may be. Hence it is very desirable that one should know at just what stages the parts may be removed with the least danger, and the most favorable treatment to accord them while they are becoming established for themselves.

(a.) BY SPECIALIZED BUDS. These usually contain considerable reserve food, and when placed under favorable conditions, develop roots readily. The *bulb* is in

reality a very short stem, having its leaves crowded together, and the terminal bud in the centre. The onion bulb is made up of concentric layers, representing mostly the fleshy bases of its once-functioning leaves. In the Easter lily, the bulb is composed of fleshy scales.



Fig. 9.—Different Kinds of Cuttings.

A, rose cutting, (heel type); B, hellotrope; C, showing how to test suitableness of material—proper condition shown by clean break at 2; D, chrysanthemum; E, grape.

The *bulbel* is a smaller but similiar structure, found on the parent bulbs in *Crinum*, on the stems of the century plant, certain lilies, etc.

The *corm* lacks the definite layers of the bulbs proper. It is well illustrated by the *Crocus*, *Gladiolus*, *Cyclamen*,

and some others, all of which are ordinarily known as "bulbs."

The *tuber* is a thickened underground stem, and finds its best example in the Irish potato. The "eyes" are the latent buds which later form the stems. The Jerusalem artichoke is another illustration of the tuber.

The *rhizome* differs from the latter chiefly in being more slender, and as a fact it is usually less regular. Iris, Bermuda grass, and ferns are common illustrations. The rhizome of Iris should be broken at its weakest places. The common potato is an excellent tuber for pupils to experiment with. Cut them into pieces having two eyes each, or with various numbers, and plant in mellow soil, either outdoors or in a box inside.

(b.) BY PORTIONS OF PARENT. In all of this work, one will need to keep the knives sharp if one is to succeed, since a clean cut heals better in plant tissues, as well as in animal tissues. The part removed, may, as a cutting, form new roots for itself, as in the rose. As a scion, it is grafted upon a stock having its own roots, as in the apple, etc.

Some plants are propagated mostly from succulent tip-cuttings, as heliotrope; others, as most shrubs, from wood more or less ripened; but there are many plants of shrubby character which may easily be propagated in either of these ways. As a general rule, however, herbaceous plants are difficult to propagate except when actively growing, and one should take only the tips for cuttings. A "slip" is a small side shoot removed without the use of a knife, and having a portion of the branch from which it grew, at its base.

1. SOFT OR GREEN WOOD CUTTINGS. To determine whether the shoots are in suitable condition for use as cuttings, bend two or three of them abruptly, near the tips. They should snap, much like an edible asparagus tip; but if they bend, instead, it is an indication that the plant is not growing actively enough for

such use. The plant being in proper condition, the tips are cut off a little longer than needed for the actual cuttings. Now beginning at the base, test the stem to find its lowest brittle point, and cut the stem a little sloping, immediately below the node. Carefully remove the lower leaves, until only about one-third of the foliage surface remains. Where the leaves are large, the end halves are often removed.

The cuttings are then ready to be placed in sand to callus and form roots. The latter usually form near the callus, and in such cases, the cut made close beneath a node heals much more quickly, because of the presence of more reserve material. But in the case of wandering Jew, *Verbena*, and other plants that give off roots from the nodes, the cut may better be made well below it, and in most cases where a cut is made at the other end of a cutting, it should be some distance above a bud, to protect the latter from undue drying. The cuttings are to be firmly embedded in the sand, about an inch and a half deep; the sand must be kept moist, and the cuttings shaded. They may be placed as near as one can set them without having the stems touch, but never force the latter into the sand.

In the colder portions of the year, in California, one will need to protect the cuttings from excessive moisture, and some bottom heat, (applied by steam-pipes running under the cutting-benches) is practically a necessity for many of the tenderer sorts. The purpose of this is to hasten the process of root formation. The following list of common plants is suggested as representing those easily propagated by the above method,—geranium, marguerite, dusty miller, *Fuchsia*, snapdragon, *Coleus*, *Chrysanthemum*, *Begonia*, wandering Jew, heliotrope, *Verbena*, *Petunia*, *Lantana*, ivy geranium, nasturtium, etc. Any teacher should be able to secure some of these by asking her pupils for such as their own homes can spare, and a large number of cuttings may be rooted in a small box. If the old plants are severely pruned some time before the cuttings are want-

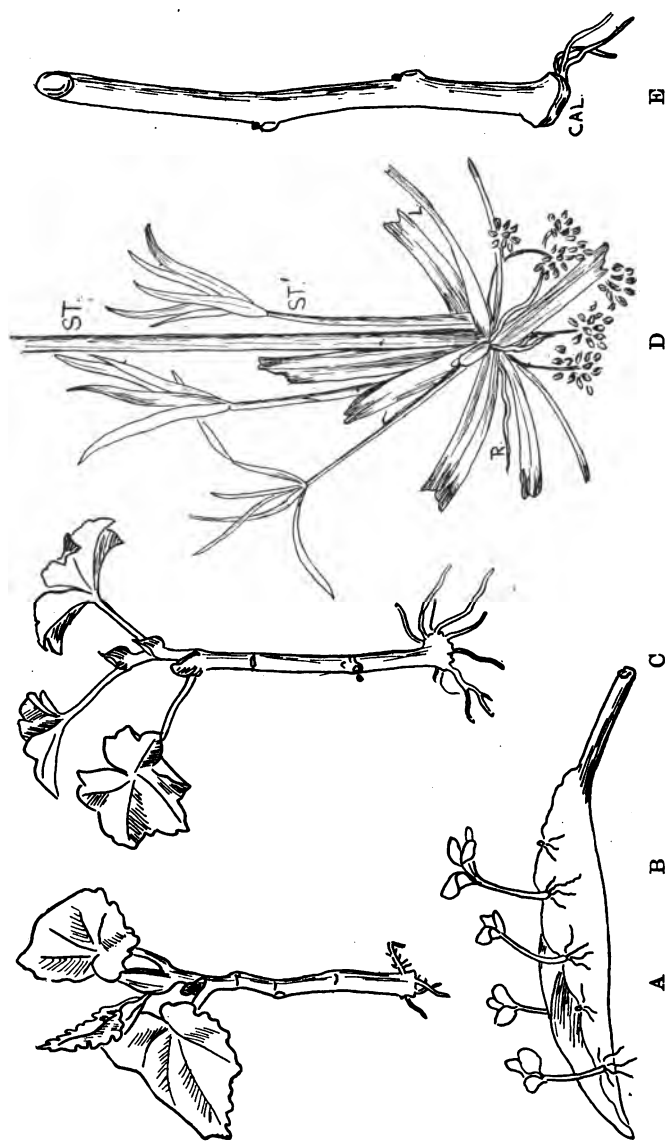


Fig. 10—Cuttings Ready For Transplanting.

A, Begonia; B, Bryophyllum leaf, showing young plants arising from notches; C, ivy geranium; D, Cyperus, or umbrella plant—ST' old stem, ST' new stem, R root, L old leaf; E Solanum Wendlandii or 'potato vine'—CAL callus from which roots arise.

ed, they will produce more shoots of a desirable character for the purpose.

2. **HARDWOOD CUTTINGS.** These are to be taken at the end of the growing season, when the tissues of the plant are well ripened, and contain reserve material. Moreover, many of the plants will have lost their leaves, and all should now be in a resting condition. The fall of the year, then, is the proper time to propagate most of our shrubs, perennial woody vines, and such trees as are multiplied in this way. Make the cuttings several inches in length, including three or four nodes, and with the lower cut close under a node. In the case of side branches, heel cuttings are best made. These get their name from the fact that the branch is cut so as to have a small portion of the main stem at its end, much like a slip. Such a cutting calluses over more readily. If the plants are of the evergreen sort, of course the lower leaves must be removed, and some kinds will need bottom heat. The following may be easily propagated by the amateur,—fig, grape, currant, quince, lilac, rose, Hydrangea, honeysuckle, Fuchsia, potato vine, trumpet vines, etc. Give these cuttings treatment similar to that recommended for the softwood cuttings, but they will require a longer time to root. To those amateurs who may wish to own a book dealing with the methods of propagating the commoner plants, the writer would recommend Bailey's Nursery Book, published by the MacMillan Company. If further details are wanted, consult an Encyclopedia Of Horticulture, of which one edited by the same writer is very well patronized by most gardeners.

If the school cannot afford a lath-house for this and other work along the line of plant production, much interest may be secured by carrying it on by means of boxes. In cutting work, one should be careful not to use soil which has in it any decaying organic matter, as manure. This is likely to cause decay of the exposed tissue, where the callus should form. But soil of a sandy nature may be used in lieu of coarse sand, if free from the above objection. Let

the teacher and her pupils experiment with various sorts of cuttings. By this means much may be learned that is both interesting and instructive. By the use of a bell-jar, it is possible to root some of the more difficult plants, even in colder weather, because one thus keeps the foliage surrounded with moisture, preventing it from undue wilting while the roots are forming. Gardeners frequently use a window-sash for the same purpose, placing it over a portion of the cutting-bench, which is partitioned off for its use.

Potting and Repotting Plants

THE SOIL. Potting soil should not be so rich for young plants or for cuttings being set in ordinary soil for the first time. A good soil for young seedlings is that composed of equal parts of sand, loam, and leaf mold, well mixed and passed through a sieve of one-quarter-inch mesh. At each shifting, make the soil a little richer by gradually substituting well rotted manure for the leaf mold and sand. Many prefer to use bone-meal instead of manure, because the worms bred in the latter are likely to prove injurious to some plants. The amount of the meal to use is about a quart to a bushel of soil. Ferns, begonias, cyclamens, and the like, should be potted in soil containing a large proportion of leaf mold, with sand.

THE POTS. Plant pots vary in size from "thumb pots," less than 2 inches in diameter, to those a foot or more across. The designations, 3-inch, 4-inch, etc., refer to the inside diameter of the pot, across the top. The pots should always be saturated with water before being used; otherwise, they will rob the soil of its moisture. If preferred, one may be able to procure the glazed pots, which do not lose water so fast. Old pots, which are slimy or dirt-clogged, should be cleaned before they are used.

***POTTING THE PLANTS.** Before beginning the work, have the pile of well-prepared soil handy; at the left stack the soaked, empty pots, and at the right place the material to be potted. The size of the pots to be used will depend largely upon the size of the plants. Experience proves that it is usually best to

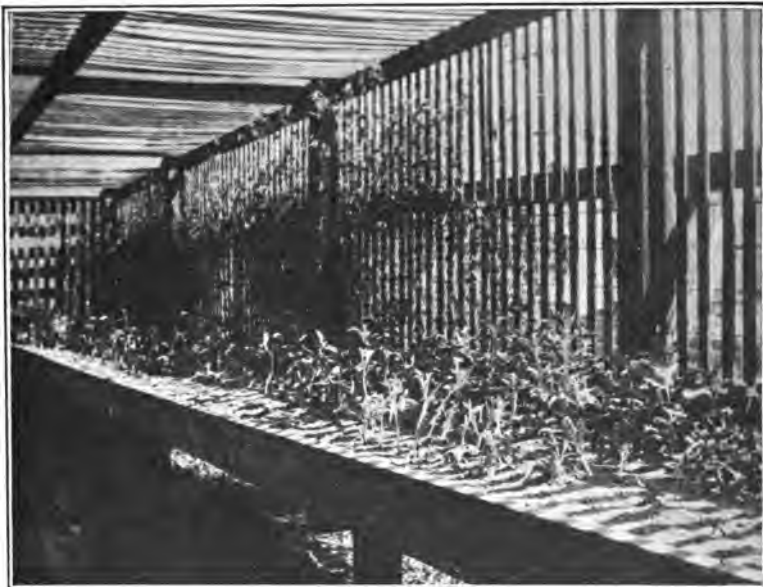


Fig. 11—Portion of Normal School Lath-house Showing Rooted Cuttings.

put plants in pots no larger than they need to accommodate their roots at the time. The explanation is easy to grasp; the roots of the potted plant are in reality penned in with a given amount of food. If this is more than the plant can use to good advantage, it suffers from a condition which we might liken to indigestion. Flowering plants will be found to bloom more profusely, if kept in comparatively small pots.

*The potting of seedlings is discussed under the head of "From Seed-boxes Into Pots," see p. 42.

If the roots of a plant are injured, or straggling, they should be pruned before it is potted; it is better to remove a root than to have to bend it abruptly in potting. Four-inch pots, and larger, are usually provided with some sort of drainage. The size of pot mentioned needs but a piece of broken pot (potsherd), over the aperture in the bottom. Larger pots require more, in proportion to the size, and some put a layer of sphagnum moss over the potsherd, to prevent it from being clogged with soil. If the circular piece does not happen to be punched out of the bottom, it may be driven out with a nail. In lieu of potsherds, one may use pieces of brick or other material.

Fill the pot half full of soil, and hold the plant in position with the left hand. With the other hand, fill in soil about the roots of the plant, and with both hands press it firmly about them and against the sides of the pot. Do not set the plants very deep, because the roots will naturally grow downward. When properly potted, the plant should be in the center of the pot, and packed so firmly that both it and the pot may be lifted by the stem. The space at the top of the pot should also hold enough water to thoroughly saturate the soil. Water after potting, and arrange the pots in an orderly manner in some shaded location. For a few days, watering would better be done sparingly.

REPOTTING. Plants which have been potted for some time may become potbound. The amateur can tell when such need repotting by removing them for inspection. Place the left hand over the soil of the pot, with the stem projecting between the fingers, and invert the plant. Still holding the latter in the left hand, give the edge of the pot a jar against some solid object, and if the soil is moist, the ball of roots will be likely to come out without injury. If the soil seems to be pretty well surrounded by roots, repotting is needed.

In this operation it is customary to use a pot of one size larger. Take the plants from the old pots, as suggested above, and remove as much of the old "shoulder" as pos-

sible, without injuring the roots. Some of the other soil might also be removed at one's discretion. When a plant has reached full size, instead of repotting, it is about as well simply to remove some of the outer top soil, and replace it with fresh, rich soil.



Fig. 12—Normal School Students Potting Plants.
(Note roots of pot-bound plant in foreground).

House Plants

The environment which the average home offers for the growing of plants is somewhat unfavorable, but owing to the great amount of crayon dust, the schoolroom is much

worse,—at least under average conditions prevailing at the present time. Consequently the list of plants suitable for indoor culture is limited to a few which will live and thrive in spite of these conditions. The following are recommended for trial:

FOLIAGE PLANTS. Anthericum—plain and striped; *Asparagus plumosus*; *Asparagus Sprengeri*, much used in hanging-baskets; *Aspidistra*; *Begonia*—several different kinds; *Bryophyllum*, which produces small plants along the edges of its leaves; *Coleus*; *Cyperus*, or umbrella plant; *Dracaena*; dusty miller; English ivy; ferns; *Ficus*, or India-rubber plant; palms; *Tradescantia*, or wandering Jew. The “strawberry geranium” also makes an attractive pot plant for indoors.

FLOWERING PLANTS. *Abutilon*, or flowering maple; *Begonia*; *Camellia*; *Cineraria*; *Cuphea*, or cigar plant; *Cyclamen*; geraniums; hyacinths; *Narcissus*—Chinese lily, daffodil, jonquil; *Petunia*.

Some very satisfactory results have been accomplished in certain schools, by having the pupils grow dwarf nasturtiums in pots and cans.

SUGGESTIONS FOR CARE. It should be definitely understood that a certain person is to have the care of the plants in a given room, and in this way responsibility is fixed. The plants should be placed in or near a window, and if they are in glazed pots, they will not dry out so quickly, but unless the soil is light the amateur is likely to produce a soggy condition by over-watering. A glazed saucer should be placed under each pot. Any plants kept at some distance from the light, should be frequently exchanged with those that have been in the light. Turn the plants every few days, to encourage symmetrical development. Water thoroughly each time they need water, and only when they are somewhat dry. Pour off the excess of water from the saucers promptly, and stir the surface of the soil at least once a week.

Syringe the foliage thoroughly, or wash it off at least every ten days. One of the most efficient devices for this operation is that known as the Scollay sprinkler, and commonly used by flower venders to freshen their stock. A sponge is also very useful in removing dust from the foliage. Potted plants would be further benefitted if ammonia were added to the water, at the rate of a tablespoonful to a gallon. The house-wife, who so successfully grows plants in her kitchen, knows the value to her charges of a moist atmosphere. A dish of water, placed on the radiator, in the season while it is supplied with heat, would prove beneficial. An occasional watering with liquid manure, especially to stimulate plants about to bloom, is often found helpful, but there is some danger of over-doing it. The liquid may be applied about once a week, and should be about the color of weak tea.

INSECT PESTS. One of the commonest insects found on plants generally, is the "green fly," or plant louse. These greenish, soft-bodied insects usually select the tenderest portions of the plant for their operations. Collecting upon the tips in large numbers, they insert their tiny beaks, and pump out the juices of the plant for food. They may be killed by a thorough spraying with some proprietary insecticide, sold at seed stores, or by dipping the plants in a soap solution. Eben Rexford, who is a well-known authority, recommends the use of ivory soap, at the rate of one-fourth pound to a pail of water. Shave the soap into a dish, cover with water, melt and thoroughly mix with the water. One should spray the foliage of the plants the day after an insecticide is applied.

The little red spider gives no trouble if the plants are frequently syringed; it will not thrive where there is much moisture. The mealy bug is a yellowish, soft-bodied insect, which gets its name from the cotton-like secretions which nearly hide the insect's body. They are treated much like plant lice, but are a little harder to kill. Scale insects are the worst pest that inside plants have. For these, use some

solution recommended by your seedsman, applying it by means of a discarded tooth brush, forcibly removing the scales. It is well to remember that all insect ravages are reduced to a minimum by keeping the plants actively growing.

Window-Boxes and their Care

It is obviously true that many schools cannot spare any considerable amount of their grounds for the purpose of establishing school gardens. Some cannot even afford to give up any of the already too small space reserved for playground, for corner or border planting. But it would seem that there can be no good excuse in cases like the latter, for neglect to grow a few plants in the windows. One may have the plants in pots set on the sill, or in boxes. These may be placed on the ledge outside, or on the sill inside. Either position has both its advantages and its disadvantages.

THE INSIDE WINDOW-BOX. This should be built strongly, of one-inch redwood, about a foot wide, eight or nine inches deep, and just long enough to fit into the window. Some, however, when there is room, prefer to set the box on a strong shelf under the window, with its top on a level with the sill. The box must have three-quarter inch holes bored six inches apart through the bottom, for drainage, and if it be given two or three coats of paint outside, all the better for the box. In lieu of such a box, built by a carpenter, one may well use a less pretentious one, of about the same dimensions. But some sort of shallow galvanized iron pan, to catch and hold the excess water, is a necessity, since very few would water so carefully that no dripping would follow. Place the box in the pan, but always keep it well off the bottom by the use of blocks. This is for the double purpose of securing proper drainage, and to prevent rotting of the box.

Now place a piece of broken pot over each hole, and

then put about an inch and a half of potsherds or other coarse material into the bottom of the box, for drainage, and fill it well towards the top with rich soil, which has preferably been sifted. It is now ready to be planted, and of course, the fall is the best time to do it, as the teacher and her pupils will get more pleasure from the plants. The inside box has the advantage, during the cold weather of the more frosty portions of the state, but when danger from killing frosts is past, the same plants will do much better away from the dry, dust-laden atmosphere of the school-room.

THE OUTSIDE WINDOW-BOX. This should be made and filled with soil as suggested above for inside boxes. Although no pan is needed under the outside box, usually, it may be advisable to place a projecting piece of galvanized iron under it, to insure the outside wall of the building from being stained by the drippings. And in this case also, the box should always be propped up to secure aeration, and to prevent decay. With the precautions here suggested, it is not likely that many school trustees or other school officers will seriously object to window-boxes, unless, perhaps on account of the cost. And as to the latter, it is undoubtedly true that many dollars of school funds are spent for purposes which do not begin to compare with the window-box in their producing value. But this is no impeachment of the judgment of school boards, for many teachers who might have this addition to their opportunities, for one reason or another have neglected to consider the matter to the extent of asking for a window-box. The writer has a conviction that a teacher will eventually receive what she asks for, if she can convince "the powers that be" that she can and will make good use of the same. In other words, we must make good use of what we have, before asking for more.

LIST OF PLANTS FOR THE WINDOW-BOX.

1. *Upright Forms.* *Asparagus sprengeri* (also much used in hanging-baskets); begonias; calla; *Coleus*; *Cyperus* or "umbrella plant;" **Dracaena*;" **Farfugium* or leopard plant; *Fuchsia*; **geranium*; *heliotrope*; **Lantana*; **marguerite*; *dwarf nasturtiums; **Petunia*; **Plumbago*; **Salvia* or scarlet sage.

2. *Trailing Forms.* *Alyssum*; climbing nasturtium; English ivy; German ivy; honeysuckle; Kenilworth ivy; *Lotus*; Madeira vine; *Mesembryanthemum* (the ice plant is one species); periwinkle (wrongly called myrtle); verbenas; wandering Jew.



Fig. 13—Window-boxes Planted With *Asparagus Sprengeri* and *Geraniums*.

SELECTION OF PLANTS. In planning for window-boxes, as for outdoor planting in general, one should

*Will do well in sunny exposure.

always keep the exposure in mind. One cannot always choose the location for the plants, but it is well to remember that a southern facing is the sunniest and most trying; the western is next, then the eastern, while the northern should be reserved for such forms as require but little sun for their best development. In Southern California, the great majority of our common plants will probably do best with an eastern exposure.

PLANTING AND CARE OF BOXES. The upright forms should be planted along the middle of the box, and a more pleasing effect is secured if two contrasting kinds are set alternately. One might, for instance, plant geranium with *Asparagus sprengeri*, Cypress, *Dracaena*, or marguerite; and in such a scheme, it is suggested that the larger-leaved form be given the central position in a three or five-plant row. *Tradescantia* cuttings are very good for planting along the inside of a window-box. They grow readily, require but little sunshine, and if the tips are pinched back occasionally, they make a more pleasing effect.

A really attractive box may be produced by simply planting a few seeds of the climbing nasturtium; besides being very inexpensive, the plants will thrive in a southern exposure with little water. However, the amateur is not likely to appreciate the rapidity with which the average window-box loses its water, being exposed to the drying action of the sun and air on all sides, as well as at the top. It is therefore much more likely that the box will suffer from insufficient watering; in hot weather, it will repay daily soaking. Whatever is planted in the window-box, the soil should always be given some sort of a mulch on the top, and there must be room left to hold the water applied. Newly-set plants had better be given shading for a few days. The inside window-box is not to be planted with the trailing forms suitable for use in the outside box, except in case one wishes to train up a plant at either side of the window. The plants will require treatment similar to that recommended for plants indoors.

The Planting of Bulbs

This is another phase of plant production not much utilized by our public schools, up to the present time; and unfortunately many of our homes as well, have lacked this enjoyable feature. In fact the one may largely account for the other. Of course bulbs need care, and cost something to begin with; but there are many kinds that will do well with average care, and which multiply so rapidly that with a small number to start with, one may soon have plenty to exchange for other kinds, or to give to his friends.

INSIDE CULTURE. To the teacher who loves flowers, and believes that the money and trouble they cost are amply compensated for, by the return, bulb-planting in pots is sure to appeal. Teachers do not usually receive large enough salaries to justify the expectation that they will spend much of their own money for materials supplied for the general good of the school. They should not do this to any considerable extent, but until the majority of our taxpayers are brought to see the value of such work to their children, many an earnest and enthusiastic teacher will, as at present, pay for plants herself, rather than teach long in a plantless schoolroom.

The bulbs which have been shown to be most suitable for indoor culture are hyacinths, several species of *Narcissus*, *freesias*, tulips, *cyclamens*, *Oxalis*, and *begonias*. The Dutch hyacinths usually produce but one rather compactly blossoming stem from each bulb, and the latter is not worth planting a second time. The Roman hyacinth, on the other hand, produces several sparsely flowering stems, and may be replanted the next season. The Chinese lily always gives satisfaction; the bulbs should be planted in a shallow dish, and kept upright by placing smooth stones about them. Provide abundance of water, and if they are given plenty of light, they run less to foliage and more to blossoms. The other bulbs suggested above, are not so easily grown, with

the exception of *Oxalis*, but make beautiful specimens when well cared for. If one attempts to grow bulbs in water, in the bulb-glasses, care should be taken that the water only touch the bottom of the bulbs, and it is well to set them in a cool, dark place, until the roots have nearly reached the bottom of the glass. Meanwhile, keep the bulbs supplied with water. A piece of charcoal will help to keep the latter sweet, and is to be put in at the time the bulb is planted.

Six-inch pots are of a desirable size for bulb planting, and some prefer the shallow pots. These are, however, not so suitable for schoolroom use, because they dry out too rapidly. Soak the pots thoroughly before using, and put about an inch of potsherds in the bottom of each, for drainage. Fill the pots nearly full of rich, mellow soil, which has enough sand to insure perfect drainage, and enough humus to enable it to retain moisture well. The bulbs are to be set in the soil so that when it is pressed firmly about them their tops will be just visible, and about an inch from the top of the pot. One may safely plant as many bulbs in a pot as it will accommodate without crowding. A six-inch pot will take three average-sized hyacinths, or about eight freesia bulbs. Unless one is careful not to let the soil under the bulbs get packed, the latter may be forced out of the soil when the roots develop. Sometimes it is wise to embed the bulbs in a nest of sand; this is especially advisable if the soil contains manure.

The bulbs are now to be labelled, then watered well and put in a cool dark place to encourage the roots to develop before the leaves begin to grow. This is very necessary if one would secure the best flowers. A good plan would be to bury the pots in the ground in some sunless location, for several weeks, when the plants may be forced, by being brought to the light and warmth. Water somewhat sparingly for the first few weeks, and then increase the amount given until blossoming time, during which the plants need plenty of water. The length of the flower stems

may easily be controlled, by governing the amount of light the plants receive. If there is a tendency on the part of the hyacinth or tulip buds to begin to color while yet well nestled between the leaves, the pots should be placed in a weak light for a while.

When through blooming, the plants are put in some out-of-the-way place, and allowed to assume gradually a resting condition. Later, the bulbs are removed from the dried soil, and stored in a dry cellar until planting time comes again.

OUTSIDE CULTURE. For the purpose of growing bulbs outdoors, one should select a partially shaded location. The soil should be deeply spaded and if it is very compact in nature, it should be given an application of well-rotted manure and sand. Most bulbs may be planted at any time that they may be found in the seed stores. As a general rule, bulbs planted out of doors are set with the tops buried to a depth equal to about twice the height of the bulb. The soil should be given water often enough to keep it continually moist.

After blooming most of our commonly planted bulbs are allowed to come gradually to rest. But it will be noticed that they do not show the tendency to do so until a few weeks after they have finished blooming and hence should be watered during this time. It is better that such bulbs be planted by themselves or at least not near plants requiring water throughout the year. Most bulbs will do better if reset every few years, and some should be dug each year after ripening, and be set again at the proper season.

The Inside Miniature Farmstead

For two years there has been in successful operation, in the Los Angeles Normal Training School, an interesting form of gardening work. It is the construction of a tiny farmstead, which is situated in a well-lighted portion of the

first grade room. There is a strong table, of ordinary height, about three feet wide, and nearly twice as long. The top was converted into a box about five inches deep, by attaching side and end pieces. It was then nearly filled with fairly rich soil, and upon this the farm home, with its natural accompaniments, was established.

Following a few suggestions given by the critic teacher and the writer, this scheme was first put into effect by one of our student teachers. The latter discussed the plan with her pupils, and together they outlined and executed the work. First, they located the buildings, and then laid out the highway, roads, walks, brook, pond, bridge, trolley line, fences, etc. The walks and drives were edged with little smooth stones, and given a covering of fine crushed rock, such as is sold in seed stores as poultry grit.

The house was of simple structure, and may be duplicated at any department store, at a cost of a few cents. The barn was correspondingly simple; any one handy in the use of cardboard could easily make these and other suitable structures for use in the work in question. But if the plan is to succeed, the pupils must be given an opportunity to contribute generously towards it, or at least be led to think that they are giving helpful assistance. And right here the teacher has an opportunity to show her skill. For, while a small child's "help" is likely to prove an annoyance to an adult. (from the viewpoint of the latter,) it is a most valuable experience to the child.

The lawn was put in, by sowing and raking in timothy grass seed, but not until the trees and shrubs had been planted. For the latter, small potted plants were used, the pots being set in the soil. But one may produce very acceptable "make-believe" trees, by planting large beans, or castor beans, corn or sunflower seeds singly in rows. The brook may be excavated, and its bottom lined with sand or tin foil. Another way to make it appear more real would be to place a long narrow piece of looking glass on the soil, and conceal the edges, irregularly, by stones, soil, plants,

etc. The pond on our little farm was a shallow dish, set in the soil. It was kept full of water, upon which real duckweed floated, and a tiny celluloid duck paddled about. Around the pond, small plants of *Cyperus* were set and near by was a tiny rockery, about which rambled little sprays of a delicate species of *Mesembryanthemum*.

In the side yard, a little summer-house was constructed out of twigs, and a single smilax vine attempted to convert it into an inviting bower of green. Along the walk leading to it one of the younger members of the family was wheeling a perambulator occupied by an infant, done in pale China. The wheat field was planted with real wheat, while the hoed crops were represented by parallel rows of radish, lettuce, etc., sown quite thick, the rows being two or three inches apart.

In the barnyard, miniature cows and sheep lived together in harmony, while fowls strutted about the chicken-yard, not far away. The faithful watch-dog was taking a nap on the mat before the front door of the house, while the family of the rancher was just returning from a ride in the new touring-car. Thus the imaginations of the little people of the first grade were given an opportunity to express themselves, and were just to that extent strengthened. The value of some such creative work, where it can be undertaken, must justify the expense and trouble.

Lawn-Making and Care

Nothing adds more to the attractiveness of the grounds about a building than a well-cared-for lawn. A number of schools which have not had sufficient ground for a garden have greatly improved the appearance of the school yard by planting and caring for a lawn. This is often but a narrow strip along the front or at one side of the building, but what a welcome change it is from the otherwise bare and uninviting surroundings! It is with the hope that other

schools may be led to follow the example that a few suggestions on the subject of lawn-making are given here.

The soil should be prepared deeply, and improved as suggested for the school garden. Many of our best gardeners are not in favor of using manure as a lawn fertilizer, because of the great number of weed seeds thus introduced into the soil, even in the case of that which is "well-rotted." Unless the soil is in need of the physical improvement that the manure would bring about, it would be better to enrich it by an application of some commercial lawn fertilizer for sale at seed stores. This is applied just after making the final preparation of the seed-bed, and at the rate of one pound to each one hundred square feet of surface.

It is advisable, especially if manure is used, that the weed seeds be germinated before the lawn seed is sown. This is best accomplished by raking the soil fairly level, and watering frequently. When the weeds are well up, go over the ground shallowly with a sharp hoe, cutting them off. Now prepare the seed-bed, making it as level and smooth as possible, and scatter the commercial fertilizer broadcast. The seed is next sown likewise. For a school lawn, it would probably be better to use Kentucky blue grass and white clover, which, however, should be sown separately, and when there is no wind. Sow at the rate of one pound of seed to every 200 square feet of surface, and lightly rake it in.

The next day the lawn should be well watered by the use of a fine nozzle attached to the hose, and much care is necessary to prevent the seed from being washed out of the soil. Watering will be necessary every evening until the small plants are well established. Weeding should be commenced as soon as the weeds are large enough to pull easily, and it should be kept up as long as necessary. The grass may be cut as soon as it is about three inches high, and if it is possible to secure the use of a roller it would be made smoother by rolling. Any future enrichment that is necessary may be given by a light application of the com-

mercial fertilizer. It is quite likely that some pupil who lives near the school would be willing to care for the lawn during vacation.

Ornamental Gardening

For the convenience of those who may wish to do something along the line of ornamental gardening, the following lists of plants are suggested.

TALL SHRUBS. Lilac, English laurel, flowering maple, coral plant (*Habrothamnus*), Cassia, laurestinus, tape plant, Japanese quince, oleander, myrtle, bottle-brush, guava, Veronica, Pittosporum, broom, syringa, tamarisk, poinsettia, rose, lemon verbena, rose of Sharon, angel's trumpet, Christmas berry, Chinese rice-paper tree, crape myrtle, fringe tree, golden bell, weigela, flowering cherry, loquat, pomegranate, arbor vitae, etc.

LOW SHRUBS. Breath of Heaven (*Diosma*), fabiana, Camellia, Daphne, Deutzia, Coprosma, Mexican orange (*Choisya*), boxwood, Turk's cap (*Achania*), Hydrangea, Fuchsia, Spiraea, barberry, Lantana, Streptosolen, Grevillea Thelemanniana, Raphiolepis, Jerusalem cherry.

PLANTS USED FOR TROPICAL EFFECTS. Bamboo, banana, Canna, castor-oil bean, Caladium, giant reed (*Arundo*), Norfolk Island pine (*Araucaria*), sago palm (*Cycas*), century plant, *Dracaena*, Japanese striped grass (*Eulalia*), Chinese rice-paper tree, fig, India rubber, palms, New Zealand flax, *Alpinia*, palm-grass, pampas grass, Egyptian paper-plant (*Papyrus*), bird of paradise (*Strelitzia*), tobacco, *Phyllodendron*, sun-flower.

TALL BORDER PLANTS. Anemone, Canna, calla, Canterbury bells, columbine, snap dragon, hollyhock, Coreopsis, Cineraria, Iris, Dahlia, heliotrope, geranium, dusty miller, Lantana, Salvia, fox glove, tobacco, lupine, golden rod, golden glow, *Gladiolus*, larkspur, Cosmos, carnation, *Pentstemon*, *Chrysanthemum*.

LOW BORDER PLANTS. Ageratum, mignonette, Oxalis, golden feather, dwarf Lobelia, English daisy (*Bellis perennis*), candytuft, forget-me-not (*Myosotis*), dwarf geraniums, Alyssum, pansy, primrose, Stevia, Coleus, Santolina, Freesia, violet, cigar plant (*Cuphea*), dwarf Lantana, hen-and-chickens (*Sempervivum*), Petunia, Telanthera, Verbena, Shasta daisy, etc.

CLIMBING AND TRAILING PLANTS. Trumpet vines, Bougainvillea, Asparagus plumosus, Clematis, creeping fig, Boston or Japanese ivy, English ivy, Coboea scandens, Virginia creeper, Dutchman's pipe, jasmine, Philodendron, Australian pea-vine, hop vine, smilax, morning glory, German ivy, snail vine, cypress vine, Madeira vine, mattress vine, Mandevillea, honey-suckle, passion vine, *Mina lobata*, potato vine, periwinkle, Plumbago, Swainsonia, Wistaria, scarlet runner bean, Lotus, climbing roses.

Where to Obtain Seeds and Plants

SEEDS FROM THE GOVERNMENT. Each year the United States Department of Agriculture distributes thousands of packets of flower and vegetable seeds through the agency of congressmen. The teacher who wishes to take advantage of this free source of seed supply, should write to her representative or senator stating what seeds she wishes and how many packets.

SCHOOL GARDEN SEEDS. The following lists of seeds and bulbs, together with the names of those offering them, are taken from "Suggestions for Garden Work in California Schools," by Ernest B. Babcock.*

1. Morris and Snow Seed Company, 425 South Main street, Los Angeles, will supply the following varieties at

*This helpful bulletin may be secured free from the state experiment station and should be in the hands of those interested in school gardening.

the rate of one cent per packet, if ordered for school garden purposes. Each packet will contain enough seed so that a row from 6 to 20 feet long can be made of each.

Vegetables

Beets	Melons, Water
Carrots	Parsley
Cucumber	Radish
Kale	Spinach
Lettuce	Turnips
Melons, Musk	

Flowers

Alyssum	Marigold
Candytuft	Morning glory
Cosmos	Mignonette
Calliopsis	Poppy
Linum (flax)	

2. The Theodosia B. Shepherd Company, Ventura, will supply the following varieties of flower seed at one cent per packet on bona fide orders from school children. Teachers endorse orders.

Abutilon	Geranium
Anchusa capensis	Gypsophila (Baby's Breath)
Arctotis grande	Heliotrope
Begonia semperflorens	Ipomoea, Heavenly Blue
Begonia Rex	Ipomoea, White Tassel
Cactus, mixed	Mignonette
Calliopsis	Nasturtium
Centaurea	Petunia Fringed Hybrids
Cobaea, scandens	Poppy, Fayal
Coleus	Poppy, Irresistible
Dahlia, Lily	Poppy, Maid of the Mist
Daisy, Blue	Poppy, Shirley
Daisy, Shasta	Stocks or Gilliflowers
Eschscholtzia, Golden West	Sweet Peas

3. Miss K. O. Sessions, P. O. Box 713, San Diego, will supply seeds to teachers in San Diego County for children's gardens at the rate of one cent per packet. San Diego teachers should write to Miss Sessions for the list of seeds offered.

4. James Vicks Sons, Rochester, N. Y., will supply seeds for children's gardens in penny packets as follows:

Flower Seeds

Asters	Morning Glory
Alyssum	Nasturtium, Climbing
Bachelor's Button	Petunia
Calliopsis	Phlox
Candytuft	Poppy
Dianthus	Scabiosa
Marigold	Sweet Peas
Mignonette	Zinnia

Vegetable Seeds

Beans	Onions
Beets	Radish
Carrots	Spinach
Lettuce	Sweet Corn

Postage two (2) cents extra for every twelve (12) packets of flower seeds, and three (3) cents extra for every twelve (12) packets of vegetable seeds. Large orders will go cheaper by express, charges to be paid by purchaser. No order for less than one dozen packets accepted.

5. Bulbs are exceedingly satisfactory, especially for the younger pupils. Carl Purdy, Ukiah, offers the following varieties of bulbs at the rate of one cent each in orders from teachers amounting to not less than one dollar: *Narcissus poeticus*, *Anemone* (St. Bridgits), *Ranunculus*, *Crocus*, *Gladiolus* (The Bride), Late Tulips, Spanish Irises.

6. The Federation of the Tree Growing Clubs of America, H. A. Green, President, Monterey, Cal., will supply tree seeds free except postage to teachers for use in school grounds or gardens or for home planting by pupils.

Other Sources of Supply in California

(1.) *PARTIAL LIST OF NURSERYMEN.* (Plants only):

Fancher Creek Nurseries, Fresno, (Burbank's introductions, etc.)
California Nursery Co., Niles.
Exotic Nurseries, Santa Barbara.
Pacific Nursery, 3041 Baker St., San Francisco.
Howard and Smith, Ninth and Olive Sts., Los Angeles.
Carl Purdy, Ukiah, (Native and Imported bulbs).
Pioneer Nursery, Monrovia.
City Nurseries, Redlands.
So. California Acclimatizing Ass'n., Santa Barbara.

California Rose Co., Pomona.
C. C. Abraham, 1600 Greenwich St., San Francisco.
E. Gill, West Berkeley.
John S. Armstrong, Ontario.
Palm Nurseries, South Pasadena.

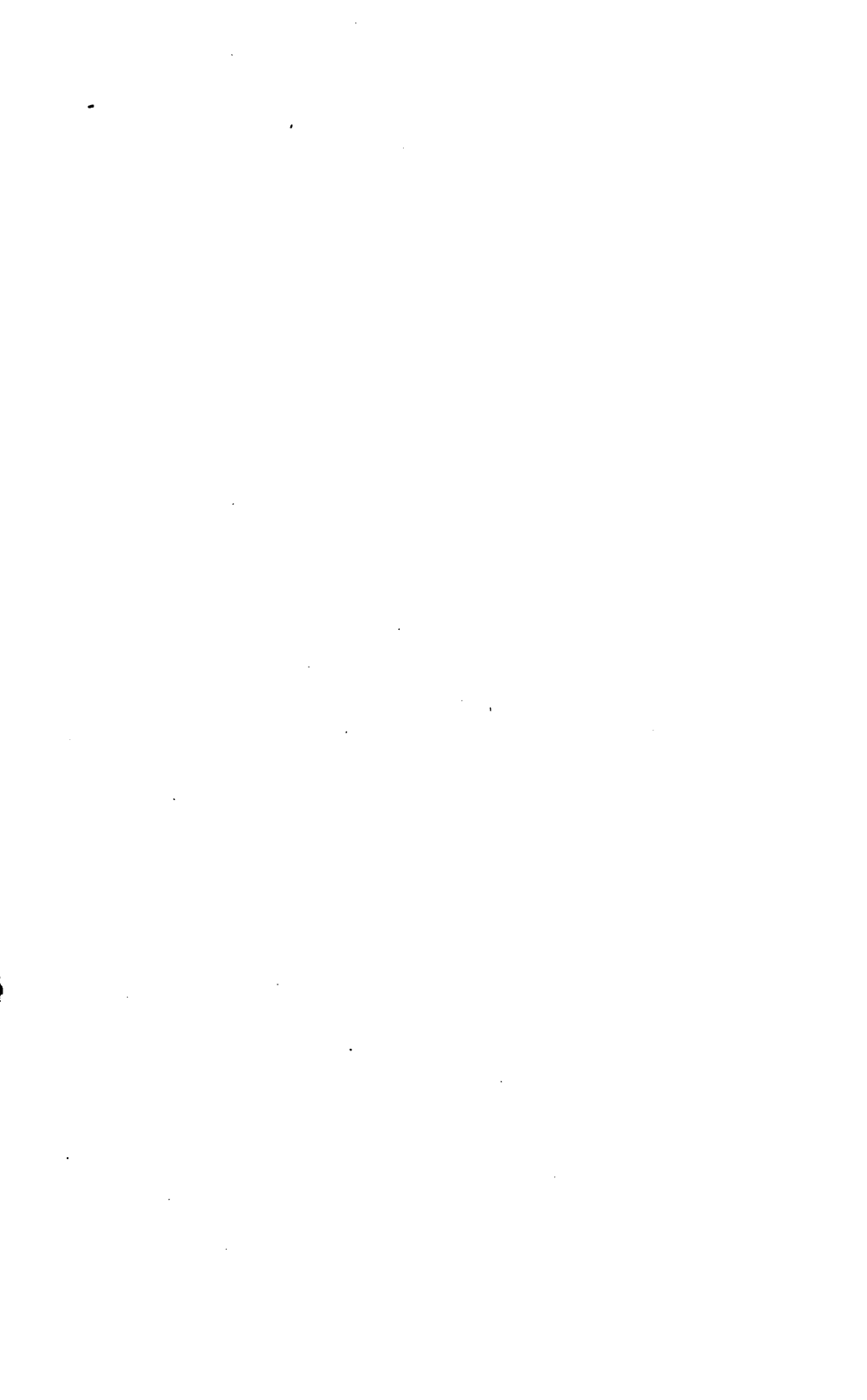
(2.) *NURSERYMEN AND SEEDSMEN.*

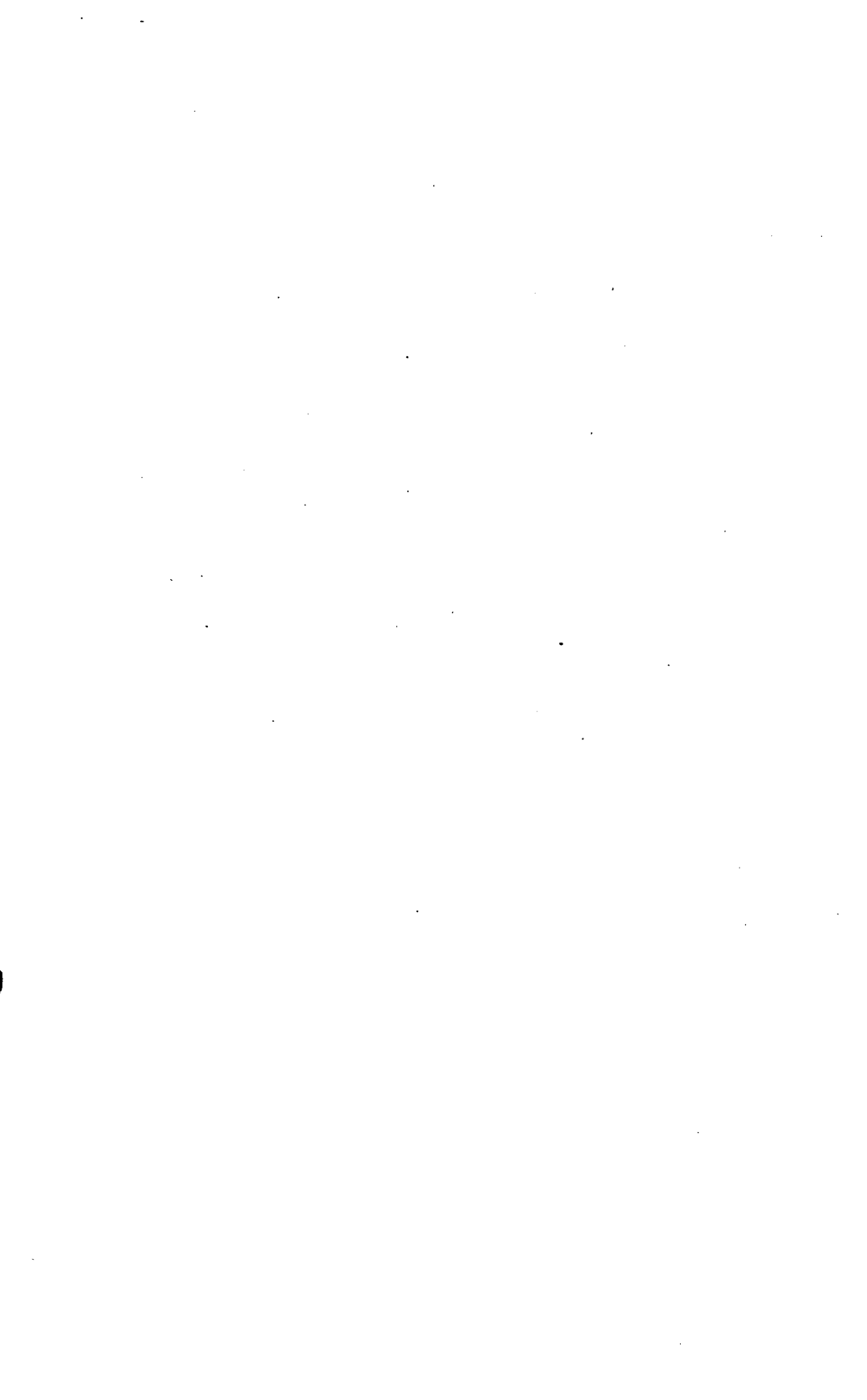
C. C. Morse & Co., San Francisco.
Trumbull Seed Co., San Francisco.
May Seed Co., San Francisco.
H. M. Sanborn, Oakland.
Charles Winsel, Los Angeles.
Theodore Payne, Los Angeles.
Aggeler & Musser, Los Angeles.
Germain Seed Co., Los Angeles.

Publications of U. S. Department of Agriculture

The writer believes that too few of our teachers are making use of the valuable printed matter issued from the United States Department of Agriculture, and to be had for the asking. Recently, there has been printed, for free distribution, a very helpful list entitled, "Free Publications of The Department of Agriculture Classified for The Use of Teachers." This list is "classified for the use of teachers of agriculture, botany, chemistry, domestic science and hygiene, geography, physics, physiology, and zoology, including entomology. The publications mentioned in this list have been selected with special reference to their suitability to supplement college and school text-books in the subjects mentioned."

Another valuable bulletin is the "Farmers' Bulletin Subject Index." If one would keep closely informed as to what the Department is publishing, he should ask to have the "Monthly List of Publications" mailed to him regularly. An extended list entitled, "Publications For Free Distribution" is issued every few months. There are indeed few schools which could not make good use of some of these publications, and it is hoped that teachers will avail themselves of this fine opportunity of procuring such of them as may be useful.







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